

**Learning to self-soothe without food: Emotion
regulation, self-compassion and eating disorders**

Rebecca Amey

D.Clin.Psy. thesis (Volume 1)

2017

University College London

UCL Doctorate in Clinical Psychology

Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature:

Name: Rebecca Amey

Date: 02/10/17

Overview

This thesis is comprised of three parts, with an overall focus on the role of emotion regulation in the maintenance of eating disorders.

Part One is a systematic review of Dialectical Behaviour Therapy (DBT) as a treatment for eating disorders. Twenty-one studies are reviewed with consideration of the methodological quality of the studies. The findings indicate that modified DBT is an efficacious treatment for adults with Binge Eating disorder (BED) and Bulimia Nervosa (BN). Research into mechanisms of action and predictors and moderators of outcome following DBT is in its infancy, and further research is necessary to establish how and for whom this treatment works.

Part Two presents empirical research into the effects of self-compassion and self-criticism on cravings to eat, affect and food consumption, in women with BED and BN. The study found that self-compassion in comparison to self-criticism, after a negative mood induction, was associated with improved mood, a reduction in the rewarding hedonic value of food, reduced food cravings and reduced food consumption. Limitations to interpretation of results are discussed, along with potential clinical applications and suggestions for future research.

Part Three provides a critical appraisal of the systematic review and empirical study. It includes a reflection of clinical observations and theoretical perspectives that informed the research questions, and a discussion of methodological considerations and dilemmas that arose through the research process. The appraisal concludes with a discussion of the findings within a broader context.

Table of Contents

Thesis Declaration Form	2
Overview	3
Table of Contents	4
List of Tables	5
List of Figures	5
Acknowledgements	7
Part 1: Literature Review	8
Abstract	9
Introduction	10
Method	17
Results	20
Discussion	39
References	47
Part 2: Empirical Paper	59
Abstract	60
Introduction	61
Method	67
Results	81
Discussion	88
References	95
Part 3: Critical Appraisal	107
References	118
Appendices	123
Appendix A: Advertising Materials	124

Appendix B: Information Sheet	126
Appendix C: Consent Form	127
Appendix D: Ethical Approval.....	128
Appendix E: Means and standard deviations of mood states and state self-compassion and self-criticism at each time point.....	129

List of Tables

Part 1: Literature Review

Table 1:	Design, setting, sample size, participant characteristics, intervention, follow-up period, outcome measures and key findings for all studies.....	23
Table 2:	Quality Appraisal of Studies.....	28

Part 2: Empirical Paper

Table 3:	Characteristics of sample and baseline comparisons between self-compassion and self-critical rumination groups.....	82
-----------------	---	----

List of Figures

Part 1: Literature Review

Figure 1:	Diagram of systematic search protocol with number of studies identified and excluded at each stage.....	21
------------------	---	----

Part 2: Empirical Paper

Figure 2:	Recruitment flowchart.....	69
Figure 3:	Timeline of experimental procedure	79
Figure 4:	Mean \pm SEM positive affect scores at three within-session time points	84
Figure 5:	Mean \pm SEM negative affect scores (PANAS) at three within-session time points	85

Figure 6:	Mean \pm SEM self-compassion (e) and self-criticism scores (f) at three within-session time points.....	86
Figure 7:	Mean \pm SEM low frequency to high frequency HRV ratio during three within-session time periods.....	87
Figure 8:	Mean \pm SEM calories consumed in each condition.....	88

Acknowledgements

I would like to thank my supervisors, Dr Lucy Serpell and Dr Sunjeev Kamboj, for their invaluable knowledge, guidance, feedback and support. This research would not have evolved to be what it was without them. I would also like to sincerely thank Cara Eilender, who volunteered her time to help with telephone screens and running the experiment. She made the efficient recruitment of participants possible and kept me smiling throughout the process.

I would also like to thank the charities, BEAT and Student Minds, for advertising the study. A big thank you also to all the participants for their interest and enthusiasm in the study, and for giving up their time to participate. Finally, I would like to express my gratitude to my family, friends and coursemates for their inspiration and support.

Part 1: Literature Review

Systematic Review of Dialectical Behaviour Therapy for Eating Disorders: Outcomes and Potential Mechanisms, Moderators and Predictors of Change

Abstract

Background: Several existing conceptual models emphasise the role of emotion dysregulation in eating disorders. Consequently, Dialectical Behaviour Therapy (DBT), with its grounding in affect regulation, has been trialled as a treatment for eating disorders.

Aim: To review the evidence base of DBT for eating disorders and identify potential mechanisms, moderators and predictors of therapeutic change.

Method: A systematic review of the literature was conducted. Studies were identified through searching five electronic databases up to April 2017.

Results: Twenty-one studies met criteria for inclusion. The findings indicate that modified DBT is an efficacious and acceptable treatment for adults with Binge Eating Disorder and Bulimia Nervosa. Although preliminary findings for Anorexia Nervosa and adolescents with eating disorders are promising, further research is needed to establish the efficacy of DBT for these client groups. The hypothesis that DBT exerts its effect through improved emotion regulation could not be confirmed because the experimental designs of the studies did not allow for this level of causal specificity to be assessed. Only one study explored predictors and moderators of DBT.

Conclusions: DBT has an emerging evidence base for its effectiveness for treating eating disorders. Further research utilizing more rigorous methodology is necessary to establish how and for whom this treatment works.

Introduction

Eating disorders are debilitating mental health conditions that have the highest mortality rate of any psychiatric disorder, due to associated medical complications and suicide (Smink, van Hoeken, & Hoek, 2012). It is estimated that more than 725,000 people in the UK have an eating disorder (Beat, 2015). Worryingly, the number of people being diagnosed and entering inpatient treatment for an eating disorder has increased at an average rate of 7% per annum since 2009 (Beat, 2015).

The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association (APA), 2013) differentiates between four main types of eating disorders: Anorexia Nervosa (AN), Bulimia Nervosa (BN), Binge Eating Disorder (BED) and Other Specified Feeding or Eating Disorder (OSFED). AN is characterised by low body weight, an undue influence of weight and shape on one's self-evaluation and a disturbance in the way one's body shape and weight is experienced, or a persistent lack of recognition of the seriousness of low body weight. Other diagnostic symptoms include an intense fear of weight gain and persistent behaviours to prevent weight gain (APA, 2013).

Individuals with BN exhibit the same over-evaluation of weight and shape, but not the emaciation as seen in AN. BN is also characterized by recurrent binge eating episodes followed by compensatory behaviours such as vomiting, laxative and diuretic misuse, excessive exercise and fasting (APA, 2013).

BED also involves persistent and frequent episodes of binge eating but in the absence of regular compensatory behaviours. Other diagnostic features include eating in secret, eating to the point of physical discomfort and feelings of disgust, guilt and shame after binge eating episodes (APA, 2013).

OSFED, formally known as Eating Disorder Not Otherwise Specified (EDNOS) in the previous edition of the DSM (4th ed.; DSM-IV; APA, 1994), is the diagnostic term given to individuals who exhibit features of AN, BN or BED but do not meet full diagnostic criteria.

Nationalistic follow-up studies suggest that the courses of eating disorders are often chronic and that many individuals do not improve without treatment. (Berkman, Lohr, & Bulik, 2007). The chronicity, distress and risks associated with eating disorders highlight the need for effective treatments for this client group. At present, cognitive behavioural therapy (CBT) has the strongest evidence base and is the treatment of choice for adults with BN and BED (National Institute for Health and Care Excellence, 2004). Yet fewer than 50% of individuals who receive this treatment fully recover (Hay, Bacaltchuk, Stefano, & Kashyap, 2009; Hay, 2013).

Interpersonal therapy (IPT) for adults with BN and BED also has an established evidence-base. However, these studies show similar outcomes at follow-up to CBT, with an average recovery rate of 50% for individuals with BN (Agras, Walsh, Fairburn, Wilson, & Kraemer, 2000; Fairburn, Jones, Peveler, Hope, & Oconnor, 1993) and BED (Wilfley et al., 1993; Wilfley et al., 2002).

To date, a number of treatments for adults with AN have been studied, including CBT, IPT, cognitive-analytical therapy, MANTRA and specialist supportive clinical management, also known as non-specific supportive clinical management. Reviews of these treatments have generally found small effect size and no superiority of one treatment over another (Schmidt et al., 2013, 2016; Watson & Bulik, 2012).

For children and adolescents, family-based treatment (FBT) is the only well established treatment for AN, with up to 60% showing remission from AN by the

end of treatment (Lock, 2015). There are no well established treatments for adolescents with BN or BED, although FBT and CBT guided self-help interventions have been identified as possibly efficacious treatments for adolescents with BN (Lock, 2015).

The above trials and evidence from routine clinical practice are characterised by high drop out rates, ranging from 25 to 40% (Swift & Greenberg, 2014), and high rates of relapse after treatment. Overall the partial recovery, significant attrition and relapse rates suggest that different theoretical conceptualisations and treatment approaches that are experienced as acceptable are needed for people with eating disorders.

An alternative model of eating disorders is the affect regulation model (Heatherton & Baumeister, 1991; Wiser & Telch, 1999). This theory conceptualises eating disordered behaviours such as bingeing, purging and dietary restraint as behavioural attempts to escape from and regulate distressing and overwhelming emotions. This theory is supported by substantial evidence that shows an increase in negative affect prior to disordered eating behaviours, such as bingeing, purging and dietary restraint, and a decrease in negative affect afterwards (Agras & Telch, 1998; Engel et al., 2013; Symth et al., 2007).

It is proposed that individuals attempt to regulate emotions in this way because they lack the skills to adaptively and effectively cope with negative affect. How adaptive emotion regulation is defined varies across the literature but much of the eating disorder research refers to Gratz and Roemer (2004) conceptualisation. They conceptualise adaptive emotion regulation according to four dimensions: 1) the ability to recognize and differentiate between different emotional states; 2) flexible use of adaptive strategies to modulate the intensity and/or duration of emotional

responses; 3) the ability to maintain behavioural control when distressed; and 4) a willingness to tolerate aversive affective states to pursue meaningful activities.

Two recent meta-analyses of emotion regulation among individuals with AN, BN (Lavender et al., 2015) and BED (Kittel, Brauhardt, & Hilbert, 2015) found that many people with eating disorders struggle with all of these domains. They found an extensive body of evidence indicating that individuals with eating disorders exhibit deficits in the awareness and recognition of emotional states, were less accepting of emotions and endorsed more negative beliefs about expressing emotions. In addition, they were less likely to utilise adaptive emotion regulation strategies such as cognitive re-appraisal, and felt less confident in the perceived effectiveness of such strategies. Furthermore, individuals with eating disorders, particularly BN, showed impulse control difficulties and found it hard to remain goal focused when emotionally distressed.

The main therapeutic approaches for eating disorders (IPT, FBT and CBT) do not explicitly address difficulties in emotion regulation and this may account for why some people do not benefit from these approaches. Indeed studies have shown that both adolescents and adults who struggle with emotion dysregulation, such as people with comorbid Borderline Personality Disorder (BPD), and those with higher levels of negative mood and impulsivity, are less likely to benefit from CBT and FBT (Agras, Crow, et al., 2000; Johnson, Tobin & Dennis, 1990; Lock, 2015; Stice & Agras, 1999; Thompson-Brenner, Boisseau, & Satir, 2010). Furthermore, enhanced cognitive behaviour therapy (CBT-E; Fairburn, 2008), which includes a module on mood intolerance, appears superior to standard CBT for individuals who have difficulty tolerating negative affective states (Fairburn et al., 2009). Hence this

subgroup of individuals with eating disorders may benefit more from therapy that also explicitly addresses emotion regulation.

At present, Dialectical Behaviour Therapy (DBT) is the most empirically supported affect-regulation therapy. It was originally developed by Linehan in 1991 to treat chronically suicidal women with BPD (Linehan, Armstrong, Suarez, Allmon, & Heard, 1991). It was based on the premise that self-injurious behaviours were functional, although maladaptive, means of coping because such individuals lack interpersonal, self-regulation and distress tolerance skills. Consequently DBT aimed to improve these through a skill based treatment programme that incorporates techniques from CBT. However, Linehan also noted that such strategies focused almost exclusively on change, which she suggested could be experienced by the individual as invalidating of their thoughts and behaviours, and of themselves as a whole. On the other hand, a therapeutic approach that is based on unconditional acceptance could be perceived as invalidating the seriousness of the problem and the need for change. Thus Linehan developed a therapy that is anchored in dialectical philosophy that encourages the balance and synthesis of change strategies and acceptance-based strategies derived from Zen Buddhism and person-centred approaches. DBT encourages the view that the individual is both acceptable as they are right now and also has the capacity for change.

DBT is a comprehensive multimodal treatment that consists of a weekly skills group, weekly individual psychotherapy, access to 24-hour phone coaching and a weekly therapist consultation group (Linehan, 1993a, 1993b). The skills training group is psychoeducational and structured specially for the learning and rehearsing of new skills to manage emotional distress. It is divided into four modules: mindfulness, emotion regulation, distress tolerance and interpersonal effectiveness.

The individual sessions and telephone coaching are designed to help the person apply the skills learnt in groups to their specific problems and goals for therapy, and to address any difficulties related to motivation to change and commitment to therapy. The therapist consultation meeting is designed to support the therapists and enhance their skills and motivation.

Telch and colleagues were the first to adapt DBT for BED (Telch, 1997a, 1997b). Within their treatment, emotion dysregulation is viewed as the core problem of BED, and binge eating is understood as an attempt to cope with painful emotions. Treatment therefore aims to facilitate adaptive affect regulation, through the DBT modules of mindfulness, emotion regulation and distress tolerance. This programme has been tested and shown to be efficacious in a number of randomised controlled trials (RCTs) and uncontrolled treatment trials (Safer, Robinson, & Jo, 2010; Telch, Agras, & Linehan, 2000, 2001). Since these promising findings, DBT has been further adapted for individuals with BN (Safer, Telch, & Agras, 2001) and AN (Lynch et al., 2013) and for both inpatient (Kroger et al., 2010) and outpatient settings (Chen et al., 2017).

A narrative systematic review of the literature of DBT for the treatment of eating disorders up to 2011 was published in 2012 (Bankoff, Karpel, Forbes, & Pantalone, 2012). In addition, a meta-analysis of the effectiveness of DBT for treating eating disorder episodes and co-occurring depression, of studies up to 2012, has been published (Lenz, Taylor, Fleming, & Serman, 2014). These reviews suggest that DBT is an effective treatment for eating disorders and other comorbidities, with the meta-analysis showing improvements in eating disorder symptoms of large effect size (Lenz et al., 2014).

Although the above reviews suggest good overall treatment effects, outcomes varied significantly between trials and participants. DBT is an intensive and relatively costly intervention. Therefore it is important to establish who benefits more from DBT than from lower intensity interventions, in order to help direct resources. Attempting to answer this involves the identification of moderators and predictors of treatment outcome. Moderators are baseline variables that interact with treatment type to affect outcomes, whereas predictors affect outcomes irrespective of treatment type (Kraemer, Wilson, Fairburn, & Agras, 2002).

Mechanisms of action are processes that occur because of treatment that cause therapeutic change (Kazdin, 2007). It is theorised that DBT produces therapeutic change through the mechanism of improved emotion regulation (Wiser & Telch, 1999). Clarifying the mechanisms of action through which DBT operates is essential to advance the development of this treatment, as this would enable the therapeutic procedures that effectively trigger the mechanisms of action to be intensified and redundant elements removed (Kazdin & Weisz, 1998). The result is likely to be a more potent, efficient and cost-effective therapy. In addition, understanding how and why DBT has its effects may also contribute to our understanding of processes involved in the maintenance of eating disorders (Kramer et al., 2002).

Studies examining potential mechanisms of action vary in terms of the causal specificity that can be assessed according to their design. Correlational designs enable the identification of an association between a hypothesised mechanism and outcome, but do not enable causal inferences. Similarly, regression analysis enables predictions about potential mechanisms by determining the statistical relationship between treatment, hypothesised mechanism and outcome, but again cannot establish

causal specificity. Stronger evidence comes from mediation analysis, as all mechanisms of action are mediators, however not all mediators are mechanisms of action (Kramer et al., 2002). However, these types of analyses are all useful for identifying potential mechanisms. Once these have been identified subsequent RCTs, component and dismantling studies, which manipulate the components associated with the hypothesised mechanism, can be undertaken to establish whether the variable is indeed a mechanism (Kazdin, 2011).

This review therefore aims to synthesise the updated body of literature on DBT for eating disorders and to identify possible mechanisms, moderators and predictors of therapeutic change. It also aims to assess the methodological rigour of the studies, firstly to help evaluate what conclusions can be drawn from the literature and secondly to provide recommendations for future research.

Method

Inclusion and Exclusion Criteria

Studies were included in the systematic review if they met the following criteria:

- Participants met diagnostic criteria for AN, BN, BED, OSFED or EDNOS according to the DSM-5 (APA, 2013), DSM-IV (APA, 1994) or the International Classification of Diseases and Related Health Problems (10th revision.; ICD-10; World Health Organisation, 1993). Studies which included participants presenting with subthreshold symptoms according to DSM-IV criteria were also included if they would now meet DSM-5 criteria for AN, BN, BED or OSFED.
- DBT was identified as the primary therapeutic intervention.
- Included an outcome measure that assessed eating disorder symptoms.

- Participants were twelve years of age or older.
- The study design was a RCT, non-randomised control trial, uncontrolled pretest-posttest design, or a follow-up study or secondary analysis exploring predictors or moderators of treatment outcome, or mechanisms of action.
- The study was published in English in a peer-reviewed journal.

Publications were excluded if they were case or case-series studies, books, book chapters, book reviews, published abstracts, conference proceedings, reviews, treatment guidelines or manuals, theses or dissertations.

Search Strategy

Five electronic bibliographic databases (CINAHL, Embase, Medline, PsychINFO, and Web of Science Core Collection) were searched from inception to April 2017, to identify relevant studies. The search terms consisted of the following keywords "eating disorder*" OR "disorder* eating" OR anorexi* OR bulimi* OR binge* OR "eating disorder not otherwise specified" OR "EDNOS" OR "other specified eating disorder" or "OSFED" AND "DBT" OR "dialectic* behavio* therap*" OR dialect*, combined with subject heading searches "eating disorders" and "dialectical behaviour therapy" where available. Results were limited to articles written in English in peer-review journals within databases where this function was possible.

After extracting all the results from each database, duplicate references were removed. Titles and abstracts were then screened against the inclusion criteria and studies that clearly did not meet criteria were removed. Full text papers of the remaining studies were read to determine whether full inclusion criteria were met.

The reference lists of all papers selected for inclusion were searched for further relevant studies.

Assessment of Study Quality

The methodological quality of the studies included in this review was assessed by the first author using a modified version of the Downs and Black (1998) quality appraisal tool. This scale was chosen because of its applicability to both RCTs and uncontrolled treatment trials. The Down and Black quality appraisal tool assesses four areas that contribute to the methodological quality of the study: reporting, internal validity, external validity and power. The scale was modified by removing some questions that were not as applicable to the type of studies included and adding further questions to assess the strength of internal/external validity and robustness of findings. For example, questions assessing therapist compliance with the intervention and whether the study included a follow-up period were included. In addition, power was assessed according to whether the study mentioned undertaking a power analysis. The quality appraisal tool consisted of 28 items in total that could be scored either 1 if the criterion was met, or 0 if it was not met or if it was not possible to determine, except for power which was scored 3 if the criterion was met. The scale provided a quality percentage score based on number of criteria met for quality of reporting, external validity, internal validity and power, which were combined to provide an overall quality percentage.

Synthesis of Studies

A meta-analysis was not feasible for this review because of the considerable heterogeneity across studies with respect to study designs, sample characteristics,

outcome measures, and the format and length of DBT (Boland, Cherry, & Dickon, 2014). Therefore a systematic narrative synthesis rather than an updated meta-analysis was undertaken.

Results

Electronic and hand searches located 549 citations, which, once duplicates were removed, left 261 to be screened for possible inclusion. Following the review screening protocol, 21 studies were identified as meeting inclusion criteria and were included in the systematic review. Figure 1 summarises the search process, the number of citations identified, included and excluded at each stage, and lists the reasons for exclusion.

Study Characteristics

Study design, authors and location. The 21 studies selected for inclusion were of 17 separate samples. Eight of the primary studies were RCTs and nine were uncontrolled treatment trials. Four studies reported the analysis of mechanisms or, moderators and predictors of treatment outcomes of three of the included RCTs and one uncontrolled treatment trial. In total, seven of the studies were by the original US developers of DBT for BED and BN, Safer, Telch and colleagues; eight further studies took place in the USA, four were conducted in Canada, one in Germany and one in the UK.

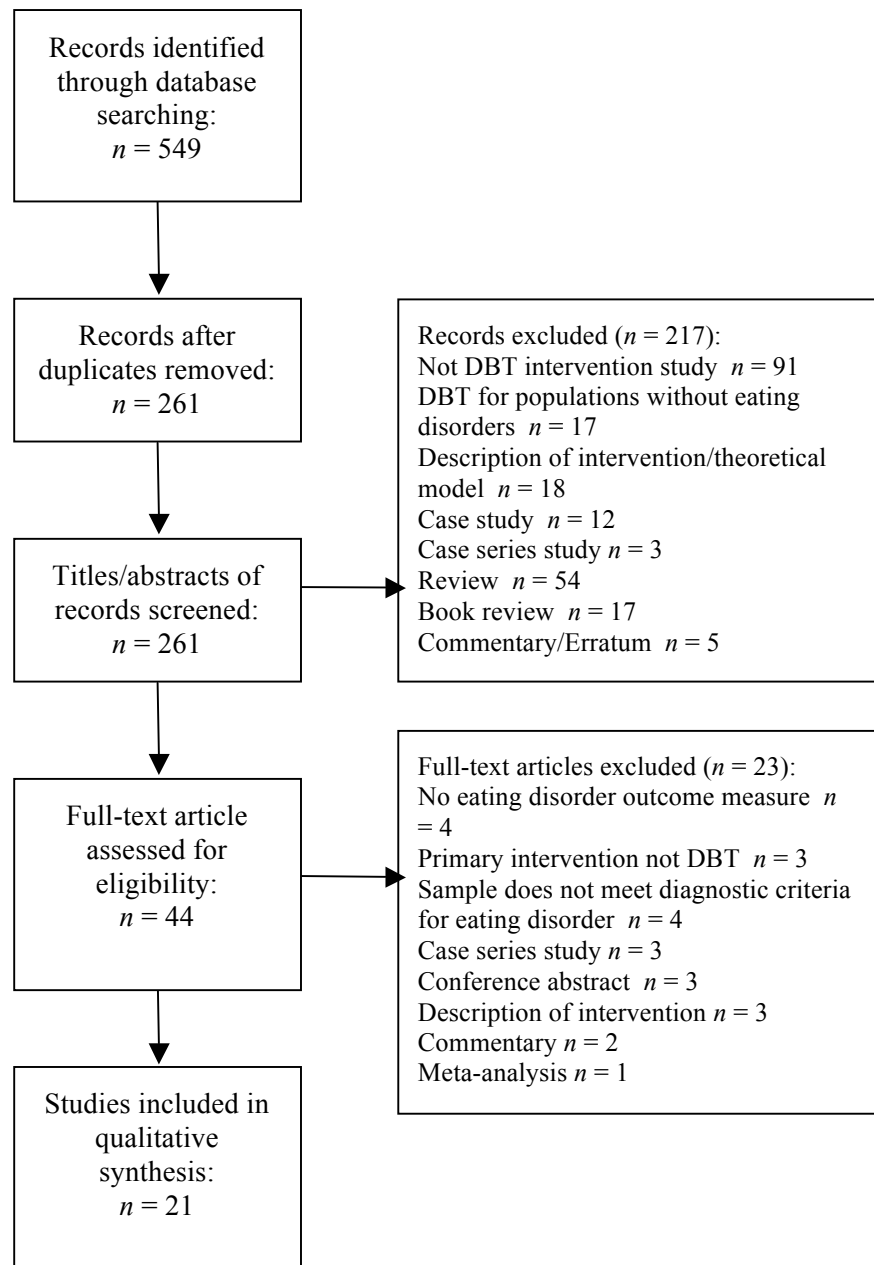


Figure 1. Diagram of systematic search protocol with number of studies identified and excluded at each stage.

Participants (referral source, setting and participant characteristics).

Participants were recruited from a range of sources and studies took place in varied settings. Five studies were conducted in university settings and recruited all or some participants through media advertisements (Klein, Skinner, & Hawley, 2012, 2013; Safer et al., 2010; Telch et al., 2000; Telch, Agras, & Linehan, 2001). Two recruited

service users attending eating disorder outpatient services (Chen et al., 2017; Johnston, O’Gara, Koman, Baker, & Anderson, 2015) and one took place in a specialist substance misuse and eating disorder outpatient service (Courbasson, Nishikawa, & Dixon, 2012). Three studies recruited service users attending day hospitals (Ben-Porath, Federici, Wisniewski, & Warren, 2014; Ben-Porath, Wisniewski, & Warren, 2009; Murray et al., 2015); and two took place in specialist inpatient services (Kroger et al., 2010; Lynch et al., 2013). One recruited individuals seeking bariatric services (Mushquash & McMahan, 2015). Finally, three studies did not specify the setting (Hill, Craighead, & Safer, 2011; Masson, von Ranson, Wallace, & Safer, 2013; Safer et al., 2001).

The total number of participants across the primary studies was 768. Nineteen of the studies included adult participants and two included adolescent participants only. In total 88% (n=677) of the participants were adults. The mean age of adult participants was 36.7 years old. 12% (n=91) of the total participants were adolescents, and their mean age was 15.2 years old.

Ninety-six percent (n=650) of adult and 100% (n=91) of adolescent participants were female. All but one of the studies provided information about the ethnicity of participants. The majority of adult participants (86%, n=579) and adolescent participants (63%, n=25) were Caucasian.

Fifty-one percent (n=204) of adult participants were diagnosed with BED, 30% BN (n=204), 15% AN (n=104) and 4% (n=28) EDNOS. The majority of adolescents were diagnosed with BN (n=46, 51%), with other participants meeting criteria for EDNOS (n= 28, 31%) and AN (n= 17, 18%). Full details of the study design, participant characteristics, description of the intervention and key findings of each study are presented in Table 1.

Table 1
Design, setting, sample size, participant characteristics, intervention, follow-up period, outcome measures and key findings for all studies

Authors (Year) Country	Design	Setting	Sample size	Mean age (SD)	Sample gender and ethnicity	Sample description (referral source, diagnoses)	Summary of intervention and control	Follow-up period (months)	Attrition (%)	Main outcome measures	Key findings
Ben-Porath, Federici, Wisniewski, & Warren (2014) USA	Uncontrolled pre-post	Day treatment program	65	Adults 23.4 (6.6)	100% female 93% Caucasian	clinical sample 34% AN 66% BN	Weekly DBT skills group adapted for ED (4 core modules) + CBT for ED + in vivo exposure to food during shared meals. Mean tx length: 22 days, 30 hrs/week.	x	15%	BMI EDE-Q DERS	Improvement ED symptoms (reduction binge purge episodes & EDE-Q except weight/shape concerns), AN increase BMI of large effect size. Improved ER.
Ben-Porath, Wisniewski, & Warren (2009) USA	Uncontrolled pre-post	Day treatment program	71	Adults 26.0 (7.7)	97% female 95% Caucasian	clinical sample 18% AN 42% BN 39% EDNOS 40% comorbid BPD	Full DBT programme ^a + nutritional groups, yoga + in vivo exposure to food during shared meals. Mean tx length: 73 days, 30 hrs/week.	x	21%	EDE-Q NMR BAI BDI	Reduction EDE-Q & depressive sx. Improved ER. No impact of comorbid BPD dx on ED outcomes. Prior treatment ED-BPD less able to regulate affect but by end of tx no difference ER between ED-BPD & ED groups.
Chen et al. (2017) USA	RCT	Outpatient	109	Adults 38.2	100% female 73% Caucasian	clinical sample 72% BED 28% BN	4 weeks of GSH. <i>Strong responders</i> ^b continued with GSH (cGSH), <i>weak responders</i> ^c randomised to 6 months full DBT programme or CBT+. CBT+ weekly group & individual CBT therapy, access 24hr psychiatry resident on-call & weekly therapist case conferences.	6 12	7%	OBD BMI EDE LIFE GAF	<i>Strong responders</i> no longer in clinical range after 4 weeks GSH and this was sustained throughout 12-month follow-up. <i>Weak responders</i> to GSH, showed similar reductions in OBD post DBT and CBT+, and were no longer in clinical range post-tx and at follow-up. Across all groups, OBD improvements decreased slightly during 12-month follow-up but were significantly better sustained in DBT relative to cGSH.
Courbasson, Nishikawa & Dixon (2012) Canada	RCT	Specialist substance use and mental health outpatient clinic	25	Adults 32.5 (10.4)	100% female 100% Caucasian	clinical sample 50% AN 36% BN 14% BED 40% BPD current substance misuse	RCT: 1 year DBT vs TAU DBT: Full DBT programme adapted for ED & SUD. TAU: weekly group + individual therapy based on motivational interviewing, CBT & relapse prevention.	3 6	DBT: 20% TAU: 80%	EDE EDI EES NMRS ASI BDI DTICQ-8	Due to high attrition rate in TAU only DBT group data analysed. DBT: reduction binge eating episodes, EDE, EDI, substance misuse severity/use & depressive sx. Improved ER associated with reduced emotional eating & increased confidence in ability to resist urges to use substances but not with reduction in binge eating episodes.

Hill, Craig & Sater (2011) USA	RCT	Not specified	32	Adults 22.0 (4.6)	100% female 94% Caucasian	sample not specified 100% BN	RCT: Appetite-focused (AF) DBT vs waitlist control (WLC). AF-DBT: 12 individual sessions integrated appetite awareness training with DBT skills.	x	AF-DBT: 15% WLC: 14%	BDI EDE-Q EES NMR IA-E	6 weeks: AF-DBT fewer BN sx than controls improved appetite awareness but not ER. AF-DBT post-tx: 27% binge purge abstinence & 62% no longer met DSM criteria for BN, improved ER.
Johnston, O'Gara, Komar, Wood Baker & Anderson (2015) USA	Uncontrolled pre-post	Outpatient	51	Adolescents 14.8 (1.5)	100% female no information ethnicity	clinical sample 33% AN 12% BN 55% EDNOS 10% ADHD 4% ASD	DBT skills groups (4 core modules) + body image module + family & multifamily sessions based on FBT and DBT. Tx length: 8 weeks (3-4hrs/day, 3 days/week)	3 6 12	29%	EDE-Q WFH	12 month follow-up: 64% treatment completers weight restored & 42% scored within non-clinical range EDE-Q. The remainder remained symptomatic, no significant difference in binge/purge frequency post-tx or at follow-up.
Klein, Skinner & Hawley (2012) USA	Uncontrolled pre-post	University Clinic	10	Adults 39.6 (9.5)	100% female 100% Caucasian	university students/staff & clinic referrals 20% BN 80% BED Excluded BPD	Condensed 16-week DBT skills group adapted for ED (3 core modules) ¹⁰ + access to limited telephone coaching.	x	50%	Binge eating frequency EDI	Reduction binge eating episodes & improvements EDI subscales & bulimia, ineffectiveness, perfectionism & interpersonal distress but not drive for thinness or body dissatisfaction.
Klein, Skinner & Hawley (2013) USA	RCT	University clinic	36	Adults 34.9	100% female 81% Caucasian	university staff/students & clinic referrals 69% sub/full threshold BED, 31% sub/full threshold BN Excluded BPD.	RCT: DBT vs DBT diary card self-monitoring (DCSM). DBT: 15 session DBT adapted for ED (3 core modules) + telephone coaching. DCSM: daily DCSM of ED symptoms + 16 weekly 15min individual sessions focused on DC compliance.	x	DBT-BED: 64% DCSM 14%	Binge eating frequency EDI	Both tx reduction binge eating frequency & bulimic symptoms & improved interoceptive awareness, improvements greater for DBT. DBT also associated with decrease in EDI subscales drive for thinness, body dissatisfaction, perfectionism & ineffectiveness.

Kroger et al. (2010) Germany	Uncontrolled pre-post	Specialist BPD inpatient unit	24	Adults 31.1 (7.6)	100% female 100% Caucasian	clinical sample 38% AN-BPD 63% BN-BPD 100% previous ED tx, high % comorbid axis I disorder.	3 month inpatient treatment: full DBT programme + CBT module + supervised meals+ contingency management of weight gain.	15	0%	BMI EDI GAF GSI of SCL-90-R	15 month follow-up: 54% remission rate for BN & 33% AN; 44% AN crossed over to BN, and 1 BN developed AN. AN BMI increased at follow-up but not post-tx. BN episodes decreased post-tx & at follow-up. EDI, general psychopathology & global functioning improved post-tx & at follow-up.
Lynch et al. (2013) UK	Uncontrolled pre-post	ED inpatient unit	47	Adults 27.2 (10.0)	96% female 94% White-British	Inpatient referrals 100% AN-R 39% previous inpatient tx	Radically open DBT: full DBT program adapted for behaviours of over-control. Mean tx length: 21.7 weeks (range 3-53 weeks).	x	27%	BMI EDE-Q EDOLS CORE	Increase BMI of large effect size, 35% full remission & 55% partial remission, improved QoL & decrease in psychological distress.
Masson, Ranson, Wallace & Safer (2013) Canada	RCT	Not specified	60	Adults 42.8 (10.5)	88% female 92% Caucasian	community sample 100% BED	RCT: DBT-GSH vs waitlist control. DBT-GSH: Participants received GSH manual of DBT-BED + 6 biweekly 20min support phone calls over the 13 weeks of treatment.	6	DBT-GSH: 30% EDE-Q EDOLS WLC: 10%	Binge abstinence EDE-Q EDOLS DERS	DBT-GSH greater reduction binge eating episodes than controls (6 vs 14.4 in past 28 days), greater % of abstinence from binge eating (40% vs 3.3%), improved EDOLS, EDE-Q & ER. Binge eating abstinence rates decreased to 30% at follow-up.
Murray et al. (2015) USA	Uncontrolled pre-post	Day Hospital Program	40	Adolescents 14.7 (1.1)	100% female 64% Caucasian	clinical sample 100% BN	Individual, parent and multitality sessions based on FBI and DBT. Mean tx length: 77 days (3-10 hrs/day 6 days week).	x	13%	EDE-Q DERS	Improvement ED symptoms (reduction binge purge episodes & EDE-Q). Improvement access emotion regulation strategies but no global improvement DERS or other DERS subscales.
Mushquash & McMahan (2015) Canada	Uncontrolled pre-post	Community bariatric service	11	Adults 44.6 (16.3)	community sample 91% female 82% Caucasian	100% BED seeking bariatric surgery/ medical weight management services	Condensed 10-week DBT skills group adapted for BED (4 core modules).	x	9%	BES EES NMRS PHO-9 GAD-7 RSE	Reduction binge eating severity, no change ER, depressive sx, anxiety or self-esteem.
Robinson & Safer (2012) USA	Secondary analysis of (2010) RCT	University clinic	101	Adults 52.2 (10.6)	85% female 76% Caucasian	community and clinic referrals 100% BED 43% PD	Secondary analysis examining potential moderators of post-tx outcome.	3 6 12	DBT: 4% ACGT: 33%	Binge days	2 moderators of post-tx outcome: 1) early age of onset of being overweight & dieting (<15 years) & 2) avoidant PD =less binge days when received DBT tx compared to ACGT.

Safer & Joyce (2011) USA	Secondary analysis Safer et al (2010) RCT	University clinic	101	Adults 52.2 (10.6)	85% female 76% Caucasian	community and clinic referrals 100% BED 43% PD	Secondary analysis examining prognostic significance of rapid response (RR), (RR is defined as >65% reduction in OBE days between treatment session 1 and 4).	3 6 12	DBT: 4% ACGT: 33%	Binge abstinence RR	RR associated with better rates of binge abstinence post-tx (70.7% vs 33.3%) & at 12-month follow-up (70.7 vs 40%). RR associated with increased likelihood of remaining in treatment & expectations of success. RR did not differ from non-RR on any baseline demographic or clinical variables.
Safer, Lively, Telch & Agras (2002) USA	Secondary analyses Telch et al (2000, 2001) studies	University clinic	32	Adults 49.2 (9.9)	100% female, 91% Caucasian	community sample. 100% BED	Secondary analysis examining factors related to relapse after completing DBT.	6		Binge abstinence	Early age of onset of binge eating (< 16) & greater EDE restraint post-tx strongest predictors of relapse.
Safer, Robinson & Jo (2010) USA	RCT	University clinic	101	Adults 52.2 (10.6)	85% female 76% Caucasian	community and clinic referrals 100% BED 43% PD	RCT: DBT-BED vs Active Comparison Group Therapy (ACGT). DBT-BED: 20 week DBT skills group (3 core modules). ACGT: 20 week supportive therapy control group.	3 6 12	DBT: 4% ACGT: 33%	Binge abstinence EDE EES DERS NMR	Binge abstinence & reduction binge frequency achieved more quickly for DBT-BED than ACGT (post tx abstinence rates=64% DBT-BED vs 36% ACGT), though differences did not persist at 3-, 6- and 12-month follow-up (12 month 64% vs 56%). Secondary outcome measures revealed no sustained impact on ER.
Safer, Telch & Agras (2001) USA	RCT	Not specified	31	Adults 34.0 (11.0)	100% female 87% Caucasian	community and clinic referrals 100% sub/full criteria BN	RCT: DBT-BN vs waitlist control. DBT-BN: 20 sessions of weekly individual DBT adapted for BN.	x	DBT: 14% WL/C: 7%	Binge abstinence EDE EES NMR	DBT reduction binge/purge episodes & 28% abstinent from bingeing/purging vs 0% waitlist control. No significant differences between groups on secondary measures.
Telch, Agras & Linehan (2000) USA	Uncontrolled pre-post	University clinic	11	Adults 45.0 (11.7)	100% female 91% Caucasian	community sample 100% BED 36.4% PD	20 week DBT skills group adapted for BED (3 core modules).	3 6	0%	Binge abstinence EDE EES NMR	Post-tx & at follow-up no one met DSM criteria for BED & 82% abstinent from binge eating. Improvements in ER, emotional eating, EDE & depressive sx. Mean weight loss 8.6lbs.

Telch, Agrad, Linehan (2001) USA	RCT	University clinic	44	Adults 50.0 (9.1)	100% female 94% Caucasian	community sample 100% BED 27% PD	RCT: DBT-BED vs waitlist control DBT-BED: 20 week DBT skills group (3 core modules).	3	6	DBT: 18% WLC: 27%	Binge abstinence EDE EES NMR	89% binge abstinent post DBT tx vs 12.5% controls & showed reduction EDE except for dietary restraint. DBT-BED less urge to eat when angry but no difference on other measures of ER/mood/self-esteem. Abstinent rates reduced to 67% at 3-month & 56% at 6-month follow-up.
Wallace, Masson, Safer & Ransan (2014) Canada	Secondary analysis of Masson et al (2013) RCT	Not specified	60	Adults 42.8 (10.5)	88% female 92% Caucasian	Community sample 100% BED	Secondary analysis examining whether changes in ER are associated with abstinence from binge eating post-tx among individuals who received DBT gsh.	4	6	GSH-DBT: 35%	Binge abstinence DERS	Degree improvement ER predicted abstinence from binge-eating post-tx & at 4-, 5-, and 6-month follow-up.

Note. AN=Anorexia Nervosa; ASI=Addiction Severity Index; BAI=Beck Anxiety Inventory; BD=Beck Depression Inventory; BED=Binge Eating Disorder; BES=Binge Eating Scale; BMI=body mass index; BN= Bulimia Nervosa; BPD=Borderline Personality Disorder; CBT=Cognitive Behaviour Therapy; CORE=Clinical Outcome in Routine Evaluation; DBT=Dialectical Behaviour Therapy; DERS=Difficulties Emotion Regulation Scale; DSM= Diagnostic and Statistical Manual of Mental Disorders; DTCQ-8=Drug Taking Confidence Questionnaire Short Version; dx=diagnosis; ED=eating disorder; EDE=Eating Disorder Examination; EDE-Q=Eating Disorder Examination Questionnaire; ED=Eating Disorder Inventory; EDNOS=Eating Disorder Not Otherwise Specified; EDQI-S=Eating Disorder Quality of Life Score; EES=Emotional Eating Scale; ER=emotion regulation; FBI=Family-Based Treatment; GAD-7=Generalised Anxiety Questionnaire; GAF=Global Assessment of Functioning Scale; GSH=Guided Self-Help; GSI=Global Severity Index; IA-E=The Interoceptive Awareness Scale-Expanded; LIFE=Longitudinal Interview Follow-up Evaluation; NMR=Negative Mood Regulation Scale; OBDD=Objective binge days; PHQ-9=Patient Health Questionnaire; PD=personality disorder; QOL=quality of life; RCT=randomised control trial; RSE=Rosenberg Self-Esteem Scale; SCL-90-R=Symptom Checklist-90-Revised; SUD=substance use disorder; sx=symptoms; TX=treatment; WFH=weight for height; x=no follow-up period.

^a Full DBT programme refers to DBT programme consisting of group skills training, individual sessions, access to telephone coaching and team consultation meeting

^b strong responders was defined as >65% reduction in OBD or vomiting frequency (whichever was more frequent) from baseline to after 4 sessions of GSH.

^c weak responders was defined as <65% reduction in these behaviours.

^d 3 core modules excludes interpersonal module.

Quality Appraisal

The percentage of quality criteria met for reporting, external validity, internal validity, internal validity due to selection bias, power and overall quality, ranged from 40% to 90%, and is summarized in Table 2. Methodological quality of studies will be referred to throughout the following synthesis of the research.

Table 2

Quality Appraisal of Studies

Study	Design	Percentage of Quality Criteria Met					
		Reporting (%)	External Validity (%)	Internal Validity Bias (%)	Internal Validity Selection Bias (%)	Power (%)	Overall (%)
Ben-Porath et al. (2014)	Uncontrolled pre-post	100	0	43	17	0	50
Ben-Porath et al. (2009)	Uncontrolled pre-post	91	0	57	17	0	50
Chen et al. (2017)	RCT	100	67	86	83	100	90
Courbasson et al. (2012)	RCT	91	67	86	33	0	67
Hill et al. (2011)	RCT	91	0	86	67	0	67
Johnston et al. (2015)	Uncontrolled pre-post	91	100	57	0	0	57
Klein et al. (2012)	Uncontrolled pre-post	100	67	43	0	0	53
Klein et al. (2013)	RCT	100	33	43	50	0	60
Kroger et al. (2010)	Uncontrolled pre-post	100	67	57	33	0	63
Lynch et al. (2013)	Uncontrolled pre-post	91	67	57	33	100	70
Masson et al. (2013)	RCT	91	33	100	50	100	80
Murray et al. (2015)	Uncontrolled pre-post	82	67	43	33	0	53
Mushquash & McMahan (2015)	Uncontrolled pre-post	64	0	43	33	0	40
Robinson & Safer (2012)	Secondary analysis	82	33	86	67	0	67
Safer & Joyce (2011)	Secondary analysis	100	33	86	67	0	73
Safer et al. (2002)	Secondary analysis	73	33	86	50	0	60
Safer et al. (2010)	RCT	100	33	86	67	100	83
Safer et al. (2001)	RCT	91	0	43	67	0	57
Telch et al. (2000)	Uncontrolled pre-post	82	67	86	33	0	63
Telch et al. (2001)	RCT	91	33	86	50	0	67
Wallace et al. (2014)	Secondary analysis	73	33	100	50	0	63

Results of the studies

DBT for BED and BN. Telch and colleagues modified standard DBT into a 20-session group format for BED (DBT-BED). Unlike standard DBT, their programme did not include an interpersonal effectiveness module, individual sessions or telephone coaching. In an uncontrolled treatment trial (Telch et al., 2000) and two RCTs, which compared DBT-BED to a waitlist control (Telch et al., 2001) and an active comparison group therapy (ACGT; Safer et al., 2010), abstinence rates (no binges in last 28 days) post-treatment were high (ranging from 64% to 89%), and were maintained at 6- and 12-month follow-up. Furthermore, participants showed an improvement with large effect sizes pre- to post-treatment in eating disorder symptoms measured by the EDE-Q. Intent-to-treat (ITT) analyses yielded a significantly higher post-treatment abstinence rate of 64% for DBT-BED compared to 33% for ACGT. This provides preliminary evidence that some change in outcome was attributable to specific components of DBT rather than non-specific therapy elements. However, this difference in recovery was no longer significant at 12-month follow-up (64% DBT vs 49% ACGT). The absence of a no therapy control questions whether this reflects a delayed therapeutic effect of the control therapy or natural remission of symptoms over time.

Safer et al. (2001) further adapted DBT-BED for individuals with BN. In a RCT comparing 20 individual sessions of DBT to a waitlist control, 29% of the DBT group achieved abstinence from binge-purge episodes compared to 0% of the waitlist control. An additional 36% reduced their number of binge-purge episodes by 88%.

The only study comparing DBT to an evidence-based treatment was by Chen et al. (2017). Individuals with BED or BN accessing an eating disorder outpatient clinic received four weeks of Guided Self-Help CBT (GSH). Based on their response

to GSH, they were grouped into 1) early strong responders who continued with GSH or 2) early weak responders who were randomised to either 6-months DBT or modified CBT. DBT consisted of weekly skills group, individual therapy, access to 24-hour phone coaching and therapist consultation team. CBT also consisted of individual and group sessions, access to 24-hour psychiatry resident on-call and therapist case conferences, to control for treatment dosage. The results showed that strong responders to GSH no longer fell within the clinical range of eating disorder symptoms after 4 weeks of GSH and this was sustained throughout the 12-month follow-up. After intensive CBT or DBT treatment, weak responders also significantly decreased their number of binge episodes to within a nonclinical range. Participants receiving DBT, frequency of vomiting also fell within the non-clinical range post-treatment, whilst those receiving CBT remained in the clinical range until 12-month follow-up. Across all groups, improvements slightly decreased during follow-up but were significantly better sustained in the DBT relative to continued GSH.

Masson et al's. (2013) RCT compared DBT for BED as a GSH treatment to a wait-list control. 40% achieved binge abstinence and 23% of participant's EDE-Q scores fell within one standard deviation of community norms after DBT-GSH, compared to 3% of the waitlist control. However, this reduction was not well maintained over time, with only 30% remaining abstinent at 6-month follow-up.

Klein and colleagues investigated the effectiveness of a condensed 16-week version of DBT-BED plus limited telephone coaching for individuals with BED and BN, in an uncontrolled treatment trial (Klein et al, 2012); and to a single component of DBT: diary card self-monitoring (Klein et al, 2013). Diary card self-monitoring is an integral part of DBT-BED that involves daily monitoring of emotions and eating

disorder symptoms and urges. They found significant improvements in binge eating frequency and compensatory behaviours after both the group-based DBT and diary card self-monitoring, although improvements were greater for group DBT. However, more than half of the participants dropped out of these studies.

Mushquash and McMahan (2010) evaluated a 10-week DBT skills group for people with BED on a waitlist for bariatric and weight management services. They found a significant reduction in binge eating severity as measured by the Binge Eating Scale.

Finally, Hill et al. (2011) investigated the efficacy of a modified version of DBT: appetite-focused DBT (AF-DBT) for individuals with BN to a waitlist control. AF-DBT consisted of 12 individual sessions based on the same core modules as Telch and Safer's modified DBT treatment. However, unlike DBT-BED, this approach also encouraged self-monitoring of appetite. Monitoring was hypothesised to promote regular eating, which has been shown to be the strongest predictor of early response to CBT for BN (Wilson, Fairburn, Agras, Walsh, & Kraemer, 2002). Halfway through treatment, participants showed reduced BN symptoms and improved appetite awareness compared to the waitlist control. Post-treatment, 27% of the ITT sample achieved abstinence from binge-purge episodes and 62% no longer met full or subthreshold DSM-IV criteria for BN.

The methodological quality of the studies conducted by Telch's group are high. The RCTs included large samples, had sufficient statistical power to adequately test for the primary outcome, assessments were conducted blind, treatment was manualised, and therapist adherence and client adherence to the treatment was closely monitored. Most studies also showed high retention of participants, suggesting acceptability of these forms of DBT for BED and BN. The other studies

(Klein et al, 2012, 2013; Mushquash & McMahan, 2010) did not employ such vigorous controls, were based on small sample sizes and suffered from high attrition rates, which were not accounted for in the analyses. Thus any conclusions regarding condensed forms of DBT-BED, the relevance of particular components of treatment, and DBT for people with BED seeking bariatric surgery are tentative.

DBT for AN. Lynch conceptualised AN as a disorder of excessive inhibitory control and developed a modified DBT programme that targets severe behavioural and emotional over-control, which he named Radically Open DBT (RO-DBT; Lynch, Hempel, & Dunkley, 2015). Like standard DBT, RO-DBT consists of mindfulness, interpersonal effectiveness, emotion regulation and distress tolerance modules. However, these focus on decreasing over-control, for example by encouraging the experience and expression of emotions rather than masking feelings. The programme also consists of a radical openness module, which covers areas such as flexible responding to changing environments and being open to others. The structure of RO-DBT is the same as DBT in that it incorporates weekly skills groups, individual therapy, telephone coaching and weekly therapist consultation meetings.

Lynch et al. (2013) evaluated RO-DBT integrated into an existing inpatient treatment for adults with AN restricting type. Consecutively referred adults to the inpatient unit, who met inclusion criteria for the study, started the treatment programme. Treatment lasted on average 22 weeks. 73% completed treatment, of which 35% were in full remission and 55% partial remission. Full remission was defined as the cessation of severe dietary restriction as measured by the restraint subscale of the EDE-Q and a body mass index (BMI) greater than 18.5. Partial remission was defined as meeting either of these two criteria.

Overall the results appear promising. However, just under a quarter of the sample had multiple admissions during the study period. In addition, RO-DBT formed part of an existing multi-component, multidisciplinary approach to treatment. As there is no comparison to treatment outcomes prior to the implementation of RO-DBT, it is difficult to ascertain whether the addition of RO-DBT led to the positive outcomes.

DBT for complex eating disorders with comorbid personality disorders and substance misuse. Two studies evaluated DBT as part of an integrated day treatment programme for individuals with mixed eating disorder presentations requiring more intensive input than outpatient treatment can provide. A high percentage of the sample across the two studies also had comorbid BPD. Ben-Porath et al. (2009) examined full DBT, including a skills group, individual therapy, access to telephone coaching and staff consultation, as part of a partial hospital program, which also included nutritional groups, yoga and shared meals. Treatment lasted on average 73 days. Post-treatment, participants reported a significant reduction in EDE-Q scores to within two standard deviations of community norms. No other eating disorder outcomes were reported.

In a subsequent trial, Ben-Porath et al. (2014) evaluated a DBT programme that consisted of the skills group only, as part of a day hospital programme. This programme was much shorter (average 22 days) and included other evidence-based approaches such as CBT. The study found a significant improvement in some eating disorder symptoms, such as a reduction in binge-purge episodes and an increase in BMI for service users with AN, but no improvement in weight and shape concerns.

Kroger et al. (2010) evaluated the effectiveness of a 3-month inpatient DBT programme. This programme included all of the elements of full DBT plus standard CBT and inpatient interventions for eating disorders, such as supervised meals and contingency management of weight gain. Consecutively referred women with AN-BPD or BN-BPD, who had on average two previous failed eating disorder specific inpatient treatments, participated. No one dropped out of treatment. 54% of individuals with BN and 33% with AN recovered, 44% with AN crossed over to BN, and one person with BN then additionally met criteria for AN at follow-up.

A large body of research has documented significantly elevated rates of alcohol and substance dependence among people with eating disorders (Wolfe & Maisto, 2000). Despite this common co-occurrence, alcohol and drug dependence was an exclusion criteria for the majority of the trials described above. Courbasson et al. (2012) were the first researchers to evaluate DBT adapted for individuals with both eating disorders and concurrent substance misuse disorders. Consecutively referred females to a specialist outpatient substance use and mental health clinic were randomised to either a year-long DBT or treatment as usual (TAU). TAU consisted of both group and individual therapy based primarily on motivational interviewing, CBT and relapse prevention. The TAU group suffered from significantly high attrition, with only 20% remaining in TAU compared to 87% of the DBT group, thus rendering direct comparisons between the two groups redundant. Analysis of the DBT group only showed a significant reduction of binge eating, EDE scores and substance misuse severity pre- to post-treatment.

Overall the above studies suggest that DBT can help reduce eating disorder symptoms among individuals with complex eating disorder presentations and comorbid personality disorders and substance misuse. The high retention rates across

all studies are impressive given that clients with BPD and substance misuse are a difficult population to retain in treatment. Furthermore, the inclusion of clients with comorbid presentations and consecutive referrals to routine clinical services increases the generalisability of the findings. However, DBT was often one component of treatment packages that included other evidence-based interventions. Furthermore, none of the above studies included a control group and those that included a follow-up period did not control for exposure to further treatment(s) during the follow-up period. Thus, it is currently difficult to know whether DBT constitutes the active component of these treatment programmes.

DBT for adolescents with eating disorders. Two uncontrolled treatment trials of DBT for adolescents with eating disorders have been published. Both trials investigated combined DBT, FBT and multi-family therapy. Murray and colleagues' study of adolescents with BN, found a significant reduction in the frequency of binge-purge episodes and weight and shape concerns by the end of treatment (2015). The other uncontrolled trial included adolescents with mixed eating disorder presentations (Johnston et al., 2015). Post-treatment participants had gained weight and at one-year follow-up 64% were fully weight restored and menstruating normally. 42% of these also scored within one standard deviation of community norms on the EDE-Q. The remainder remained symptomatic and overall there was no significant difference in binge-purge frequency throughout treatment or at follow-up.

The above studies provide preliminary evidence of the utility of DBT for adolescents with eating disorders. However, again the lack of control groups and multi-component treatment approaches, which included other evidence-based

interventions such as FBT, limits any conclusions about whether the results were attributable to DBT. In addition, the studies are based on small sample sizes and Johnston's study suffered from high drop rates (29%), which were not taken into account in the analysis, thus limiting the generalisability of the results.

General Psychopathology. A high percentage of participants presented with comorbid mood and anxiety disorders. Of the nine studies that measured depressive symptoms, five showed improved mood and/or remission of depression after DBT (Ben-Porath et al., 2009; Courbasson et al., 2012; Hill et al., 2011; Kroger et al., 2010; Telch et al., 2000); and four found no significant change in depressive symptoms post-treatment (Mushquash & McMahan, 2015; Safer et al., 2010; Safer et al., 2001; Telch et al., 2001). The two studies that measured rates of comorbid Axis I disorders pre- and post-treatment found significant reductions in the number of comorbid disorders post-treatment (Chen et al., 2017; Kroger et al., 2010).

DBT was also associated with improvements in psychosocial functioning, psychological distress and quality of life (Chen et al., 2017; Kroger et al., 2010; Lynch et al., 2013; Masson et al., 2013).

Is improved emotion regulation a mechanism of action? One psychological mechanism that is hypothesised to be integral in the development and maintenance of eating disorders is emotion dysregulation (Heatherton & Baumeister, 1991; Wiser & Telch, 1999). It is therefore theorised that DBT results in improved eating disorder symptoms through the process of improved emotion regulation.

To examine the association between emotion regulation and eating disorder symptoms, six of the uncontrolled treatment trials included an assessment of emotion

regulation pre- and post-treatment. Two of the RCTs also compared emotion regulation at the end of DBT to waitlist controls (Safer et al., 2001; Telch et al., 2001). Emotion regulation was assessed using a variety of measures, including the Emotional Eating Scale (EES; Arnow, Kenardy, & Agras, 1995), the Negative Mood Regulation Scale (NMRS; Catanzaro & Mearns, 1990), and the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The EES measures the extent individuals feel the urge to eat when experiencing negative emotions such as anger, depression or anxiety. The NMRS examines individuals' perceived ability to cope with negative mood states by using cognitive and behavioural strategies. The DERS measures four dimensions of emotion regulation including non-acceptance of emotions and access to emotion regulation strategies. The findings from the studies are inconsistent. Four studies that found a reduction in eating disorder symptoms also found improvements in emotion regulation or a reduced desire to eat when experiencing negative emotions (Ben-Porath et al., 2014; Ben-Porath et al., 2009; Hill et al., 2011; Telch et al., 2000). However, two studies found no change in emotional eating or the ability to regulate emotions pre- to post-treatment despite improvements in eating disorder symptoms (Murray et al., 2015; Mushquash & McMahan, 2015). In addition, the studies that compared DBT to a waitlist control, did not find any difference between the groups in emotion regulation although a reduction in eating disorder symptoms in the DBT group was found (Safer et al., 2001; Telch et al., 2001).

One study examined the correlation between changes in emotion regulation, emotional eating, substance misuse and binge eating frequency (Courbasson et al., 2012). This study found that improved emotion regulation was correlated with decreased emotional eating and increased confidence in the ability to resist urges to

use substances. However, contrary to prediction, improved emotion regulation was not correlated with decreases in binge eating frequency.

Wallace et al. (2014) found that the magnitude of change in emotion regulation, as measured by the DERS, predicted binge abstinence post guided self-help DBT treatment and at follow-up. Finally, the RCT by Safer and colleagues that compared DBT to an active control therapy, found improvements in emotional eating of small effect size after DBT. However, by 12-month follow-up the active comparison group in fact reported fewer emotion regulation difficulties than the DBT group (2010). No studies analysed whether treatment outcomes were mediated by changes in emotion regulation using mediational analyses.

Other processes associated with improved outcome following DBT. Safer and colleagues' found that rapid response, which is defined as a 65% reduction in binge eating frequency within the first 4 weeks of treatment, predicted greater rates of abstinence of binge eating post-treatment and at 1-year follow-up (Safer & Joyce, 2011).

Moderation findings. Only the RCT comparing DBT to an active therapy control explored potential moderators of treatment outcome (Robinson & Safer, 2012). Several variables were tested as moderators including demographic variables, eating disorder symptoms and general psychopathology variables. The analysis identified two moderators of treatment outcome. Participants with a diagnosis of avoidant personality disorder or an early onset of being overweight and dieting (<15 years old) evidenced significantly better outcomes with DBT compared to the active therapy control.

Predictor findings. Two studies explored predictors of outcome at the end of treatment and at follow-up. Ben-Porath et al. (2014) compared outcomes of individuals with BPD to those without this diagnosis following a DBT day treatment programme. They found that while those with BPD showed more severe eating disorder symptoms pre-treatment, there was no significant difference between the two groups on the EDE-Q post-treatment, suggesting that BPD status predicted greater improvement in DBT. Finally, an analysis of relapse rates of individuals who achieved abstinence from binge eating after DBT treatment, found that early age of onset of binge eating (<16 years) and the degree of dietary restraint post-treatment was predictive of relapse (Safer, Lively, Telch, & Agras, 2002).

Discussion

The aim of this systematic review was to synthesise the updated body of literature on DBT for eating disorders and to identify possible mechanisms, moderators and predictors of therapeutic change. The qualitative findings of this review indicate that the modified version of DBT for BED, developed by Telch (1997a, 1997b), is an efficacious treatment for adults with BED. Both of the RCTs investigating this form of DBT showed significant reductions in the frequency of binge eating episodes, with between 64 and 89% achieving abstinence from bingeing post-treatment (Safer et al., 2010; Telch et al., 2001). These rates of abstinence are equivalent to outcomes for group CBT and IPT for BED (Wilfley et al., 2002). DBT for BED was also associated with reductions in other eating disorder symptoms such as weight and shape concerns and dietary restraint. Condensed forms of this treatment and the GSH version do not show such high rates of recovery (Klein et al.,

2012, 2013; Masson et al., 2013), and conclusions regarding the outcomes of DBT for individuals with BED seeking bariatric services are limited by the methodological quality of the research.

DBT for individuals with BN (Hill et al., 2011; Safer et al., 2001) showed lower abstinence rates from binge-purge episodes post-treatment, with between a quarter and a third achieving abstinence from these behaviours. However, these rates are equivalent to outcomes in a multisite study of CBT and IPT for BN (Agras, Walsh, et al., 2000).

Overall the methodological quality of studies evaluating modified DBT for BED and BN by the original developers are high, lending further support to the conclusions that these are efficacious treatments with equivalent outcomes to other evidence-based treatments.

Few studies have evaluated DBT as a treatment for AN. DBT as part of a day hospital programme (Ben-Porath et al., 2014) and inpatient programmes (Kroger et al., 2012; Lynch et al., 2013) was associated with increases in BMI of large effect size. This is equivalent to the outcome of a meta-analysis of day and inpatient treatment for adults with AN (Hartmann, Weber, Herpertz, & Zeeck, 2011). However, among the studies of DBT for AN, many scored within the clinical range on the EDE-Q post-treatment. Additionally, 44% of individuals with AN in Kroger et al's. (2010) study developed BN. This could suggest that although these treatments are associated with initial weight gain, they may not be addressing the underlying maintaining factors. In addition, as DBT was added to existing inpatient and day programmes, it is not clear how much improvement was attributable to DBT itself without a control group. RO-DBT is also substantially different theoretically to other DBT programmes for eating disorders. Thus the variability in DBT programmes

implemented across the studies makes it difficult to generalise about the outcomes of DBT for AN.

Studies examining DBT for individuals with complex and severe presentations, such as those with chronic eating disorders, personality disorders, multiple Axis I disorders and substance misuse, implemented DBT programmes that are more consistent with the original DBT programme developed by Linehan (1993b). As with Linehan's programme, these studies evaluated DBT consisting of weekly skills based groups, individual therapy, access to telephone coaching and staff consultation. The review found that this multimodal form of treatment was associated with reductions in the number of comorbid Axis 1 disorders, substance misuse and improved global functioning. It also resulted in reductions in eating disorder symptoms among individuals who had not responded to GSH-CBT (Chen et al., 2017) or previous inpatient treatments for eating disorders (Kroger et al., 2010). This suggests that the full DBT programme may be beneficial for those who have not responded to frontline treatments and for those with complex and chronic presentations.

In addition, Safer and colleagues' (2010) study, which compared DBT to an active therapy control, found that participants with early age of onset of being overweight and dieting and comorbid avoidant personality disorder did better with DBT than an active control therapy (Robinson & Safer, 2012). This provides further evidence that individuals with more severe and chronic presentations and comorbid difficulties may benefit more from DBT than less intensive approaches.

Preliminary studies with adolescents suggest that DBT may help reduce eating disorder symptoms. However, these conclusions are limited by the fact that DBT was part of a treatment programme that also included family-based treatments.

Therefore it is difficult to determine the relative importance of DBT. In addition, the studies suffered from high drop out rates and ITT analyses were not undertaken, thus potentially inflating the apparent outcomes. Also, the findings are based on small sample sizes, which pose further limitations on the generalisability of the findings.

DBT applied to eating disorders is based on the premise that eating disordered behaviours, such as binge eating, are attempts to cope with emotions, and hence that improved emotion regulation should result in a reduction of eating disordered behaviours. In an attempt to explore the role of emotion regulation in treatment outcome, some of the studies included an assessment of emotion regulation pre- and post-treatment. Although improvements in both emotion regulation and eating disorder symptoms were often found, correlation, regression or mediation analyses were not undertaken in the majority of studies. Thus we cannot determine whether changes in emotion regulation correlate, predict or mediate changes in treatment outcome. In addition, even if emotion regulation was found to mediate change in eating disorder symptoms, this would not strictly prove that improved emotion regulation caused symptom change (Kazdin, 2007). Kazdin specified a number of criteria for establishing mechanisms of action, including establishing temporal precedence of changes in mechanism variables by undertaking repeated measurements of mediators and outcomes throughout treatment. None of the studies employed these measures.

Furthermore, the one study that compared DBT to an active therapy control (Safer et al., 2010) found similar improvements in emotion regulation and eating disorder symptoms in both groups. This could suggest that other specific and non-specific mechanisms play a central role in the treatment effects of DBT.

Rapid response to treatment was identified as a predictor of binge abstinence at the end of treatment and at one-year follow-up (Safer & Joyce, 2011). This is consistent with the findings of two recent meta-analyses, which highlight the importance of achieving early symptom change across different treatment modalities (self-help, therapist-led) and eating disorder diagnoses (Linardon, Brennan, & de la Piedad Garcia, 2016; Vall & Wade, 2015). Patient's expectation of success was the only factor associated with rapid response (Safer & Joyce, 2011). The authors speculated that this might be because the nature of DBT as goal focused, with an emphasis on learning and practising techniques, could instil more hope and therefore lead to better outcomes.

What is striking across the evidence base of DBT for eating disorders is the low dropout rate in comparison to other treatments for eating disorders, which typically show that fewer than half of those who start treatment complete it (Swift & Greenberg, 2014). DBT is unique in that it provides an explicit framework for working with ambivalence and commitment to therapy, and in that it promotes a continual emphasis on both acceptance and change. This, and the nature of DBT as goal focused and skills based, may account for why more people remained in treatment and could be one of the factors that contribute to treatment outcomes.

Finally, previous research has found that the reduction in dietary restraint is the strongest mediator of post-treatment outcomes for both CBT and IPT (Wilson et al., 2002). Many of the included studies found a reduction in dietary restraint, and the degree of dietary restraint at the end of treatment was predictive of relapse (Safer et al., 2002). Therefore this may also be an important mechanism by which DBT exerts its effects.

Methodological considerations and limitations in the literature

One of the main limitations of the literature is the homogenous sample. The majority of participants were females, Caucasian and educated. Although this is reflective of the demographics of those seeking eating disorder services (Beat, 2015), it is not reflective of findings from eating disorder prevalence studies. Prevalence studies estimate that up to a quarter of sufferers are male (National Centre for Social Research, 2013) and that many people develop eating disorders in later life (Podfigurna-Stopa et al., 2015).

Another notable limitation was that many studies evaluated DBT as part of multi-component interventions with no control group. This limits conclusions about whether the addition of DBT resulted in improved outcomes. Furthermore, the form of DBT that was investigated varied considerably across the studies. Some studies evaluated the skills-based group component only, and these differed in terms of whether they included the interpersonal module. Other studies included the additional components of DBT such as individual therapy, telephone coaching and staff consultation. As the only study that compared different components of DBT (Klein et al., 2013) conclusions are limited by methodological quality, it is difficult to assess what the active components of DBT treatment are for whom.

Furthermore the only study that compared DBT to an evidence-based treatment, CBT, adapted CBT to include group and individual therapy, access to 24-hour phone support and case conferences (Chen et al., 2017). This is not traditionally how CBT is delivered. Thus the efficacy of DBT in comparison to other evidence-based treatments cannot be concluded. Finally, the experimental designs of the majority of studies did not allow for causal specificity of potential mechanisms of action to be assessed.

Limitations of the current systematic review

Meta-analytic evaluation would have been preferable, but due to the study heterogeneity this was not appropriate. Also, because of limited resources the first author carried out the screening process and quality appraisal independently. This, and the fact that only published research written in English was searched for, again due to limited resources, may contribute to a bias within the sample of studies included in the review.

Future recommendations

Further research in this area is needed. Future trials should include more diverse samples, including men and older adults with eating disorders. Additional studies with adults with AN and adolescents is also warranted to determine whether DBT is effective for these client groups. A development of the research is expanding DBT to those seeking weight loss treatments, such as bariatric surgery. Unfortunately, no conclusions about the outcomes of DBT for this population and for weight loss can be drawn because only one study included this client group and weight loss was not consistently measured. Research in this area is needed because obesity is a major public health concern, and having a diagnosis of BED is associated with obesity, and is predictive of worse outcomes after bariatric surgery and other weight loss treatments (Opozda, Chur-Hansen, & Wittert, 2016).

Modified DBT was associated with reductions in eating disorder symptoms post-treatment, however these improvements often decreased during the follow-up period. Thus enhancing the maintenance of effects warrants further investigation.

Finally, full DBT is intensive and relatively costly. Future studies need to employ more rigorous designs that can assess greater levels of causal specificity of potential mechanisms of change. This could help develop more effective, efficient and cost-effective therapies. Preliminary evidence suggests that those with more severe and complex presentations could especially benefit from DBT. RCTs comparing DBT to other evidence-based treatments for eating disorders, such as CBT, IPT and GSH-CBT interventions, which are less intensive than DBT, are needed to establish this. These trials should also examine moderators of treatment to further clarify what works for whom.

Conclusion

Modified DBT is an efficacious and acceptable treatment for adults with BED and BN, and could be especially beneficial for people with chronic eating difficulties, comorbid personality disorders and for those who have not responded to previous eating disorder treatments. Although preliminary findings for AN and for adolescents with eating disorders are promising, further research is needed to establish the efficacy of DBT for these client groups. The hypothesis that DBT exerts its effect through improved emotion regulation could not be confirmed because the experimental designs of the studies did not allow for this level of causal specificity to be assessed. Only one study explored predictors and moderators of DBT. Newer studies have begun to dismantle DBT to identify its key components but the findings at present are inconclusive. Further research utilizing more rigorous methodology is necessary to establish how and for whom this treatment works.

References

- Agras, W. S., Crow, S. J., Halmi, K. A., Mitchell, J. E., Wilson, G. T., & Kraemer, H. C. (2000). Outcome predictors for the cognitive behavior treatment of bulimia nervosa: Data from a multisite study. *American Journal of Psychiatry*, 157(8), 1302-1308. doi:10.1176/appi.ajp.157.8.1302
- Agras, W. S., & Telch, C. F. (1998). The effects of caloric deprivation and negative affect on binge eating in obese binge-eating disordered women. *Behavior Therapy*, 29(3), 491-503. doi:10.1016/s0005-7894(98)80045-2
- Agras, W. S., Walsh, B. T., Fairburn, C. G., Wilson, G. T., & Kraemer, H. C. (2000). A multicenter comparison of cognitive-behavioral therapy and interpersonal psychotherapy for bulimia nervosa. *Archives of General Psychiatry*, 57(5), 459-466. doi:10.1001/archpsyc.57.5.459
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders: DSM-IV*. Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: (5th ed.)*. Washington, DC: Author.
- Arnow, B., Kenardy, J., & Agras, W. S. (1995). The emotional eating scale - the development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders*, 18(1), 79-90. doi:10.1002/1098-108x(199507)18:1<79::aid-eat2260180109>3.0.co;2-v
- Bankoff, S. M., Karpel, M. G., Forbes, H. E., & Pantalone, D. W. (2012). A Systematic Review of Dialectical Behavior Therapy for the Treatment of Eating Disorders. *Eating Disorders*, 20(3), 196-215. doi:10.1080/10640266.2012.668478
- Beat. (2015). The cost of eating disorders. Social, health and economic impacts.

- Ben-Porath, D., Federici, A., Wisniewski, L., & Warren, M. (2014). Dialectical Behavior Therapy: Does It Bring About Improvements in Affect Regulation in Individuals with Eating Disorders? *Journal of Contemporary Psychotherapy*, 44(4), 245-251. doi:10.1007/s10879-014-9271-2
- Ben-Porath, D. D., Wisniewski, L., & Warren, M. (2009). Differential treatment response for eating disordered patients with and without a comorbid borderline personality diagnosis using a dialectical behavior therapy (DBT)-informed approach. *Eating Disorders: The Journal of Treatment & Prevention*, 17(3), 225-241.
- Berkman, N. D., Lohr, K. N., & Bulik, C. M. (2007). Outcomes of eating disorders: A systematic review of the literature. *International Journal of Eating Disorders*, 40(4), 293-309. doi:10.1002/eat.20369
- Boland, A. M., Cherry, G., & Dickson, R. (Eds.). (2014). *Doing a Systematic Review: A Student's Guide*. London: SAGE.
- Catanzaro, S. J., & Mearns, J. (1990). Measuring Generalized Expectancies for negative mood regulation - initial scale development and implications. *Journal of Personality Assessment*, 54(3-4), 546-563. doi:10.1207/s15327752jpa5403&4_11
- Chen, E.Y., Cacioppo, J., Fettich, K., Gallop, R., McCloskey, M. S., Olino, T., & Zeffiro, T. A. (2017). An adaptive randomised trial of dialectical behaviour therapy and cognitive behavior therapy for binge-eating. *Psychological Medicine*, 47, 703-717.
- Courbasson, C., Nishikawa, Y., & Dixon, L. (2012). Outcome of Dialectical Behaviour Therapy for Concurrent Eating and Substance Use Disorders. *Clinical Psychology & Psychotherapy*, 19(5), 434-449. doi:10.1002/cpp.748

- Downs, S.H. & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of Epidemiology and Community Health*, 52, 377–384.
- Engel, S. G., Wonderlich, S. A., Crosby, R. D., Mitchell, J. E., Crow, S., Peterson, C. B., Gordon, K. H. (2013). The Role of Affect in the Maintenance of Anorexia Nervosa: Evidence From a Naturalistic Assessment of Momentary Behaviors and Emotion. *Journal of Abnormal Psychology*, 122(3), 709-719. doi:10.1037/a0034010
- Fairburn, C. G. (2008). *Cognitive Behavior Therapy and Eating Disorders*. New York: The Guilford Press.
- Fairburn, C. G., Cooper, Z., Doll, H. A., O'Connor, M. E., Bohn, K., Hawker, D. M., Palmer, R. L. (2009). Transdiagnostic Cognitive-Behavioral Therapy for Patients With Eating Disorders: A Two-Site Trial With 60-Week Follow-Up. *American Journal of Psychiatry*, 166(3), 311-319. doi:10.1176/appi.ajp.2008.08040608
- Fairburn, C. G., Jones, R., Peveler, R. C., Hope, R. A., & O'Connor, M. (1993). Psychotherapy and bulimia-nervosa: longer-term effects of interpersonal psychotherapy, behavior therapy, and cognitive-behavior therapy. *Archives of General Psychiatry*, 50(6), 419-428.
- Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment*, 26(1), 41-54. doi:10.1023/b:joba.00000007455.08539.94

- Hartmann, A., Weber, S., Herpertz, S., Zeeck, A. (2011). Psychological Treatment for Anorexia Nervosa: A Meta-Analysis of Standardized Mean Change. *Psychotherapy and Psychosomatics*, 80(4), 216-226. doi:10.1159/000322360
- Hay, P. P. J., Bacaltchuk, J., Stefano, S., & Kashyap, P. (2009). Psychological treatments for bulimia nervosa and bingeing. *Cochrane Database of Systematic Reviews*(4), 176. doi:10.1002/14651858.CD000562.pub3
- Hay, P. (2013). A systematic review of evidence for psychological treatments in eating disorders: 2005-2012. *International Journal of Eating Disorders*, 46, 462-469.
- Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, 110(1), 86-108. doi:10.1037//0033-2909.110.1.86
- Hill, D. M., Craighead, L. W., & Safer, D. L. (2011). Appetite-Focused Dialectical Behavior Therapy for the Treatment of Binge Eating with Purging: A Preliminary Trial. *International Journal of Eating Disorders*, 44(3), 249-261. doi:10.1002/eat.20812
- Johnston, J. A., O'Gara, J. S., Koman, S. L., Baker, C. W., & Anderson, D. A. (2015). A pilot study of Maudsley family therapy with group dialectical behavior therapy skills training in an intensive outpatient program for adolescent eating disorders. *Journal of Clinical Psychology*, 71(6), 527-543.
- Johnson, C., Tobin, D., & Dennis, A. B. (1990). Differences in treatment outcome between borderline and non-borderline bulimics at one-year follow-up. *International Journal of Eating Disorders*, 9, 617-628.
- Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology*, 3, 1-27.

- Kazdin, A. E. (2011). Evidence-based treatment research: Advances, limitations, and next steps. *The American Psychologist*, 66, 685–699.
- Kazdin, A. E., & Weisz, J. R. (1998). Identifying and developing empirically supported child and adolescent treatments. *Journal of Counselling and Clinical Psychology*, 66, 19-36.
- Kittel, R., Brauhardt, A., & Hilbert, A. (2015). Cognitive and emotional functioning in binge-eating disorder: A systematic review. *International Journal of Eating Disorders*, 48(6), 535-554. doi:10.1002/eat.22419
- Klein, A. S., Skinner, J. B., & Hawley, K. M. (2012). Adapted Group-Based Dialectical Behaviour Therapy for Binge Eating in a Practicing Clinic: Clinical Outcomes and Attrition. *European Eating Disorders Review*, 20(3), e148-e153. doi:10.1002/erv.2165
- Klein, A. S., Skinner, J. B., & Hawley, K. M. (2013). Targeting binge eating through components of dialectical behavior therapy: Preliminary outcomes for individually supported diary card self-monitoring versus group-based DBT. *Psychotherapy*, 50(4), 543-552.
- Kraemer, H. C., Wilson, G. T., Fairburn, C. G., & Agras, W. S. (2002). Mediators and moderators of treatment effects in randomized clinical control trials. *Archives of General Psychiatry*, 59, 877-883.
- Kroger, C., Schweiger, U., Sipos, V., Kliem, S., Arnold, R., Schunert, T., & Reinecker, H. (2010). Dialectical behaviour therapy and an added cognitive behavioural treatment module for eating disorders in women with borderline personality disorder and anorexia nervosa or bulimia nervosa who failed to respond to previous treatments. An open trial with a 15-month follow-up.

- Journal of Behavior Therapy and Experimental Psychiatry*, 41(4), 381-388.
doi:10.1016/j.jbtep.2010.04.001
- Lavender, J. M., Wonderlich, S. A., Engel, S. G., Gordon, K. H., Kaye, W. H., & Mitchell, J. E. (2015). Dimensions of emotion dysregulation in anorexia nervosa and bulimia nervosa: A conceptual review of the empirical literature. *Clinical Psychology Review*, 40, 111-122. doi:10.1016/j.cpr.2015.05.010
- Lenz, A., Taylor, R., Fleming, M., & Serman, N. (2014). Effectiveness of dialectical behavior therapy for treating eating disorders. *Journal of Counseling & Development*, 92(1), 26-35.
- Linardon, J., Brennan, L., & de la Piedad Garcia, X. (2016). Rapid response to eating disorder treatment: A systematic review and meta-analysis. *International Journal of Eating Disorders*, 49, 905-919.
- Linehan, M. M. (1993a). *Cognitive-behavioural treatment of borderline personality disorder*. New York: Guildford Press.
- Linehan, M. M. (1993b). *Skills training manual for treating borderline personality disorder*. New York: Guildford Press.
- Linehan, M. M., Armstrong, H. E., Suarez, A., Allmon, D., & Heard, H. L. (1991). Cognitive-behavioral treatment of chronically parasuicidal borderline patients. *Archives of General Psychiatry*, 48(12), 1060-1064.
- Lock, J. (2015). An Update on Evidence-Based Psychosocial Treatments for Eating Disorders in Children and Adolescents. *Journal of Clinical Child and Adolescent Psychology*, 44(5), 707-721. doi:10.1080/15374416.2014.971458
- Lynch, T. R., Gray, K. L., Hempel, R. J., Titley, M., Chen, E. Y., & O'Mahen, H. A. (2013). Radically open-dialectical behavior therapy for adult anorexia

- nervosa: Feasibility and outcomes from an inpatient program. *BMC Psychiatry*, (13), 293-310.
- Lynch, T. R., Hempel, R. J., & Dunkley, C. (2015). Radically Open-Dialectical Behavior Therapy for Disorders of Over-Control: Signaling Matters. *American Journal of Psychotherapy*, 69(2), 141-162.
- Masson, P. C., von Ranson, K. M., Wallace, L. M., & Safer, D. L. (2013). A randomized wait-list controlled pilot study of dialectical behaviour therapy guided self-help for binge eating disorder. *Behaviour Research and Therapy*, 51(11), 723-728. doi:10.1016/j.brat.2013.08.001
- Murray, S. B., Anderson, L. K., Cusack, A., Nakamura, T., Rockwell, R., Griffiths, S., & Kaye, W. H. (2015). Integrating family-based treatment and dialectical behavior therapy for adolescent bulimia nervosa: Preliminary outcomes of an open pilot trial. *Eating Disorders: The Journal of Treatment & Prevention*, 23(4), 336-344.
- Mushquash, A. R., & McMahan, M. (2015). Dialectical behavior therapy skills training reduces binge eating among patients seeking weight-management services: preliminary evidence. *Eating and Weight Disorders-Studies on Anorexia Bulimia and Obesity*, 20(3), 415-418. doi:10.1007/s40519-015-0177-0
- National Centre for Social Research, University of Leicester. (2011). *Adult Psychiatric Morbidity Survey, 2007*. [data collection]. 3rd Edition. UK Data Service. SN: 6379, <http://doi.org/10.5255/UKDA-SN-6379-1>
- National Institute for Health and Care Excellence. (2004). *Eating disorders in over 8's management. NICE clinical guideline CG9*. London: National Institute for Health and Care Excellence.

- Opozda, M., Chur-Hansen, A., & Wittert, G. (2016). Changes in problematic and disordered eating after gastric bypass, adjustable gastric banding and vertical sleeve gastrectomy: a systematic review of pre-post studies. *Obesity Reviews*, 17(8), 770-792. doi:10.1111/obr.12425
- Podfigurna-Stopa, A., Czyzyk, A., Katulski, K., Smolarczyk, R., Grymowicz, M., Maciejewska-Jeske, M., & Meczekalski, B. (2015). Eating disorders in older women. *Maturitas*, 82(2), 146-152. doi:10.1016/j.maturitas.2015.06.036
- Robinson, A. H., & Safer, D. L. (2012). Moderators of dialectical behavior therapy for binge eating disorder: Results from a randomized controlled trial. *International Journal of Eating Disorders*, 45(4), 597-602. doi:10.1002/eat.20932
- Safer, D. L., & Joyce, E. E. (2011). Does rapid response to two group psychotherapies for binge eating disorder predict abstinence? *Behaviour Research and Therapy*, 49(5), 339-345. doi:10.1016/j.brat.2011.03.001
- Safer, D. L., Lively, T. J., Telch, C. F., & Agras, W. S. (2002). Predictors of relapse following successful dialectical behavior therapy for binge eating disorder. *International Journal of Eating Disorders*, 32(2), 155-163. doi:10.1002/eat.10080
- Safer, D. L., Robinson, A. H., & Jo, B. (2010). Outcome From a Randomized Controlled Trial of Group Therapy for Binge Eating Disorder: Comparing Dialectical Behavior Therapy Adapted for Binge Eating to an Active Comparison Group Therapy. *Behavior Therapy*, 41(3), 432-432.
- Safer, D. L., Telch, C. F., & Agras, W. (2001). Dialectical behavior therapy for bulimia nervosa. *The American Journal of Psychiatry*, 158(4), 632-634.

- Schmidt, U., Renwick, B., Lose, A., Kenyon, M., DeJong, H., Broadbent, H., Loomes, R., Watson, C., Ghelani, S., Serpell, L., Richards, L. Johnson-Sabine, E., Boughton, N., Whitehead, L., Beechman, J., Treasure, J. & Landau, S. (2013) The MOSAIC Study: Comparison of the Maudsley Model of Treatment for Adults with Anorexia Nervosa (MANTRA) with Specialist Supportive Clinical Management (SSCM) in outpatients with Anorexia Nervosa or Eating Disorder Not Otherwise Specified, Anorexia Nervosa Type - A randomised controlled trial. *Trials*. 14: 160. DOI: 10.1186/1745-6215-14-160
- Schmidt, U., Ryan, E., O'Hara, C., Bartholdy, E., Renwick, B., Keyes, A., McClelland, J., Serpell, L., Richards, L., Johnston-Sabine, E., Boughton, N., Whitehead, L., Bonin, E., Beecham, J., Landau, S. & Treasure, J. (2016). Two Year Follow-Up of the MOSAIC Trial: a Multi-Centre Randomised Controlled Trial Comparing Two Psychological Treatments in Adult Outpatients with Broadly Defined Anorexia Nervosa. *International Journal of Eating Disorders*. 49: 8, 793-800. DOI: 10.1002/eat.22523
- Smink, F. R. E., van Hoeken, D., & Hoek, H. W. (2012). Epidemiology of Eating Disorders: Incidence, Prevalence and Mortality Rates. *Current Psychiatry Reports*, 14(4), 406-414. doi:10.1007/s11920-012-0282-y
- Smyth, J. M., Wonderlich, S. A., Heron, K., Sliwinski, M., Crosby, R. D., Mitchell, J. E., & Engel, S. G. (2007). Daily and momentary mood and stress predict binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology*, 75, 629–638. doi:10.1037/0022-006X.75.4.629

- Stice, E., & Agras, W. S. (1999). Subtyping bulimic women along dietary restraint and negative affect dimensions. *Journal of Consulting and Clinical Psychology, 67*(4), 460-469. doi:10.1037/0022-006x.67.4.460
- Swift, J. K., & Greenberg, R. P. (2014). A treatment by disorder meta-analysis of dropout from psychotherapy. *Journal of Psychotherapy Integration, 24*(3), 193-207.
- Telch, C. F. (1997a). *Emotion regulation skills training treatment for binge eating disorder: Therapist manual*. Unpublished manuscript, Stanford University.
- Telch, C. F. (1997b). Skills training treatment for adaptive affect regulation in a woman with binge-eating disorder. *International Journal of Eating Disorders, 15*, 53-61.
- Telch, C. F., Agras, W. S., & Linehan, M. M. (2000). Group Dialectical Behavior Therapy for binge-eating disorder: A preliminary, uncontrolled trial. *Behavior Therapy, 31*(3), 569-582. doi:10.1016/s0005-7894(00)80031-3
- Telch, C. F., Agras, W. S., & Linehan, M. M. (2001). Dialectical behavior therapy for binge eating disorder. *Journal of Consulting & Clinical Psychology, 69*(6), 1061-1065.
- Thompson-Brenner, H., Boisseau, C. L., & Satir, D. A. (2010). Adolescent Eating Disorders: Treatment and Response in a Naturalistic Study. *Journal of Clinical Psychology, 66*(3), 277-301. doi:10.1002/jclp.20646
- Vall, E., & Wade, T. D. (2015). Predictors of treatment outcome in individuals with eating disorders: A systematic review and meta-analysis. *International Journal of Eating Disorders, 48*, 946-971.
- Wallace, L. M., Masson, P. C., Safer, D. L., & von Ranson, K. M. (2014). Change in emotion regulation during the course of treatment predicts binge abstinence

- in guided self-help dialectical behavior therapy for binge eating disorder. *Journal of Eating Disorders*, 2(1), 35. doi:10.1186/s40337-014-0035-x
- Watson, H. J., & Bulik, C. M. (2012). Update on the treatment of anorexia nervosa: review of clinical trials, practice guidelines and emerging interventions. *Psychological Medicine*, 10, 1-24.
- Wilfley, D. E., Agras, W. S., Telch, C. F., Rossiter, E. M., Schneider, J. A., Cole, A. G., Raeburn, S. D. (1993). Group cognitive-behavioral therapy and group interpersonal psychotherapy for the nonpurging bulimic individual- a controlled comparison. *Journal of Consulting and Clinical Psychology*, 61(2), 296-305. doi:10.1037/0022-006x.61.2.296
- Wilfley, D. E., Welch, R. R., Stein, R. I., Spurrell, E. B., Cohen, L. R., Saelens, B. E., Matt, G. E. (2002). A randomized comparison of group cognitive-behavioral therapy and group interpersonal psychotherapy for the treatment of overweight individuals with binge-eating disorder. *Archives of General Psychiatry*, 59(8), 713-721. doi:10.1001/archpsyc.59.8.713
- Wilson, G. T., Fairburn, C. C., Agras, W. S., Walsh, B. T., & Kraemer, H. (2002). Cognitive-behavioral therapy for bulimia nervosa: Time course and mechanisms of change. *Journal of Consulting and Clinical Psychology*, 70(2), 267-274. doi:10.1037//0022-006x.70.2.267
- Wiser, S., & Telch, C. F. (1999). Dialectical behavior therapy for binge-eating disorder. *Journal of Clinical Psychology*, 55(6), 755-768. doi:10.1002/(sici)1097-4679(199906)55:6<755::aid-jclp8>3.0.co;2-r
- Wolfe, W. L., & Maisto, S. A. (2000). The relationship between eating disorders and substance use: Moving beyond co-prevalence research. *Clinical Psychology Review*, 20(5), 617-631. doi:10.1016/s0272-7358(99)00009-4

World Health Organization. (1993). *ICD-10, the ICD-10 classification of mental and behavioural disorders: Diagnostic criteria for research*. Geneva: World Health Organization.

Part 2: Empirical Paper

The role of self-compassion and self-criticism in binge eating behaviour

Abstract:

Background: The role of self-criticism and low self-compassion is often implicated in the development and maintenance of eating disorders but the mechanisms underlying this association remain unclear.

Aim: To examine the effects of experimentally induced self-compassion and self-critical rumination on cravings to eat, affect and food consumption, in women with Binge Eating Disorder (BED) and Bulimia Nervosa (BN).

Method: 60 women with BN and BED underwent a negative mood induction and were subsequently randomly assigned to either a self-compassion or self-critical rumination induction. Participants were then exposed to food cues, followed by a taste-test. Affect, food cue reactivity and food consumption were measured.

Results: The self-compassion induction resulted in greater recovery in positive and negative affect, following the negative mood induction. Despite the differential effects on mood, self-compassion and self-critical rumination led to similar self-reported cravings to eat and physiological reactivity to food cues. However, participants in the compassion condition rated the food they ate as less pleasurable, consumed significantly fewer calories and reported less desire to continue eating.

Conclusions: The findings suggest that therapeutic interventions focusing on the cultivation of self-compassion could help individuals with BED and BN self-regulate their eating behaviour in the context of negative mood. It also suggests that this effect may be mediated by a reduction in the relative rewarding hedonic value of food.

Introduction

People with eating disorders tend to be highly self-critical (Goss, 2007) and present with high levels of shame (Grabhorn, Stenner, Stangier, & Kaufhold, 2006; Swan & Andrews, 2003; Troop, Allan, Serpell, & Treasure, 2008). Self-criticism is a form of self-to-self relating that is characterised by negative judgments and evaluations, and is often activated by failures to meet personal standards (Gilbert, Clarke, Hempel, Miles, & Irons, 2004). Explorations of the function of self-criticism suggest that people relate to themselves in this way in an attempt to self-correct and improve personal features and behaviours (Gilbert et al., 2004). In its most harsh form it appears to arise from a desire to punish oneself for having disliked qualities (Gilbert et al., 2004). Thus Gilbert and colleagues conceptualise self-criticism and self-directed hostility as defensive strategies, driven by shame (Gilbert & Procter, 2006). However, accumulating evidence suggests that the threat response elicited by self-directed attacks resembles that activated by criticism from others (Gilbert, 2000; Gilbert & Irons, 2005; Longe et al., 2010). Therefore self-criticism may trigger threat-related emotions, such as anxiety and anger, in the same way as when individuals are belittled and criticised by others. Self-criticism also appears to maintain and exacerbate perceptions of inferiority and defectiveness, and feelings of shame (Gilbert, 2009).

An alternative response to perceived shortcomings and failures could be to reassure, soothe and have compassion for oneself. Neff (2003) conceptualised self-compassion according to three components: 1) showing oneself kindness, understanding and warmth instead of criticism and self-judgment; 2) seeing one's pain, suffering and imperfections as common to humanity rather than isolating and

shaming; and 3) being mindful of one's painful thoughts and feelings rather than over-identifying with them.

Gilbert (2000, 2009) proposes that when individuals show themselves warmth and compassion it activates the soothing-affiliative system in the brain in the same way as when people are shown kindness and care by others. It is proposed that the soothing system operates via the vagus nerve and is associated with increased parasympathetic activity (Depue & Morrone-Strupinsky, 2005; Porges, 2007). The parasympathetic nervous system, sometimes referred to as the “rest and digest” system, inhibits sympathetically driven threat responses, effectively restoring homeostasis after activation of the flight-fight response (Porges, 2007). Support of the role of compassion in activating this system and downregulating threat responses comes from studies measuring the impact of imagery designed to cultivate self-compassion on physiological and psychological indices of the threat response. In a series of studies, compassionate imagery was associated with increased heart rate variability, a proxy for parasympathetic responding (Porges, 2007), as well as significant decreases in the stress hormone cortisol and alpha amylase (Duarte, McEwan, Barnes, Gilbert, & Maratos, 2015; Rockliff, Gilbert, McEwan, Lightman, & Glover, 2008).

Individuals with eating disorders report difficulty in generating feelings of self-warmth and reassurance (Goss & Allan, 2010) and can be fearful of experiencing self-compassion (Kelly, Vimalakanthan, & Carter, 2014; Oliveira, Ferreira, Mendes, & Marta-Simoes, 2017). Low levels of trait self-compassion and fears of self-compassion are also associated with poorer response to treatment among eating disorder patients (Kelly, Carter, Zuroff, & Borairi, 2013).

Goss and Gilbert's (2002) compassion-based model of eating disorders suggests that this tendency to self-attack and difficulty generating self-compassion renders individuals with eating disorders as less able to adaptively cope with negative emotions. Eating disordered behaviours, such as binge eating, therefore become the main ways of attempting to cope and escape from difficult emotions.

Binge eating is defined as episodes of consuming large quantities of food, in a short period of time, whilst experiencing a sense of loss of control over eating (American Psychiatric Association (APA), 2013). It is the hallmark feature of eating disorders such as Binge Eating Disorder (BED) and Bulimia Nervosa (BN). The two diagnoses differ in that BED does not involve the use of compensatory behaviours, such as purging and laxative misuse, after binge eating episodes that are characteristic of BN (APA, 2013).

A large body of evidence using a range of methodologies supports the affect regulation function of binge eating. For example, retrospective studies and research employing ecological momentary assessments, have frequently found an increase in negative affect prior to binge eating episodes and a decrease in negative affect afterwards (Deaver, Miltenberger, Smyth, Meidinger, & Crosby, 2003; Smyth et al., 2007; Stickney, Miltenberger, & Wolff, 1999). Similarly, experimental studies with individuals with BED have shown that experimental elevation of negative mood leads to disinhibited eating, followed by a decrease in negative affect (Agras & Telch, 1998; Schulz & Laessle, 2010).

There are different explanations for how binge eating reduces negative affect. The aversive state stress reduction hypothesis proposes that the hedonic experience of consuming highly palatable foods reduces aversive feelings (Robbins & Fray, 1980). This effect appears more pronounced in individuals with BN and BED

because of increased reward sensitivity (Farmer, Nash, & Field, 2001) and deficits in self-regulatory control in response to rewarding stimuli (Bartholdy, Dalton, O'Daly, Campbell, & Schmidt, 2016; Wierenga et al., 2014). Alternatively, the escape theory (Heatherton & Baumeister, 1991) proposes that binge eating episodes reduce negative affect by narrowing attention from higher-level abstract thinking about the self towards the immediate environment (e.g. food). Cognitive narrowing therefore precludes thinking about negative aspects of the self and the difficult emotions associated with this awareness.

Overall binge eating appears to become a conditioned response to aversive self-awareness and negative emotions, which is maintained through negative reinforcement. This process of conditioning also underlies the intense food cravings, a form of food cue reactivity, that people with binge eating difficulties report in response to negative mood and exposure to food stimuli (Sobik, Hutchison, & Craighead, 2005).

While evidence suggests that binge eating alleviates negative affect, this is usually short-lived and followed by intense feelings of shame, guilt and disgust (APA, 2013). Losing control of eating ultimately perpetuates negative self-perceptions, which add to the internal conditions for unstable and negative affect. Thus, a self-defeating and self-perpetuating cycle is maintained (Gilbert & Goss, 2002).

Compassion-focused therapy (CFT) was specifically developed to address experiences of shame and self-attack by helping people to cultivate affiliative emotions and compassion (Gilbert, 2000, 2009, 2010). This approach has recently been trialled as an adjunct to standard eating disorder treatments. The first by Gale and colleagues (2014) evaluated the effectiveness of introducing components of CFT

into their standard cognitive behavioural therapy (CBT)-based outpatient programme for adults with Anorexia Nervosa (AN), BN and Eating Disorder Not Otherwise Specified (EDNOS). They found that the combined treatment resulted in significant symptom improvement, particularly among those with BN. However, the absence of a CBT only control group, or comparisons to outcomes prior to the introduction of CFT, limits any conclusions regarding the additional benefits of CFT.

Kelly and Carter (2015) compared a three-week CFT self-help intervention for adults with BED, to a behaviourally based self-help intervention, and a waitlist control. Participants in both intervention groups received psychoeducation about the role of regular eating in reducing binge eating episodes and were encouraged to follow a structured eating plan to facilitate regular eating. Participants in the compassion group were also encouraged to practice exercises designed to cultivate self-compassion, and to draw on these at times when they experienced strong urges to binge and in response to binge eating. In contrast, participants in the behavioural self-help condition were required to engage in alternative, non-food related activities when they experienced strong binge cravings. They found that both interventions led to a reduction in binge eating frequency compared to the waitlist control, but that the self-compassion group showed the greatest improvements in eating disorder symptoms.

The most recent study by Kelly et al. (2017) evaluated a 12-week group-based CFT as an adjunct treatment to outpatient treatment as usual (TAU) for individuals with mixed eating disorder diagnoses. They found that CFT+TAU resulted in greater improvements in self-compassion, shame and eating disorder symptoms compared to TAU.

This preliminary evidence suggests that adjunctive compassion-focused interventions can improve therapeutic outcomes for people with eating disorders. However, as the above intervention studies consisted of many components, it is not clear which treatment components were responsible for the effects. One way of identifying the specific and individual contribution of a therapeutic strategy is to examine this strategy in isolation under controlled laboratory conditions (Kazdin, 2007).

An example of this approach is Adam and Leary's (2007) study, in which they directly manipulated self-compassion in response to diet breaking. In their study undergraduate females with highly rigid and restrained eating patterns were asked to eat a preload of unhealthy foods, in an attempt to mimic diet breaking. Half of the participants were then primed to think self-compassionately about what they had eaten, while the control group received no intervening intervention. Afterwards participants were presented with a fake 'taste-test' and the amount of food they consumed was measured. Adam and Leary (2007) found that those who were primed to think self-compassionately about their eating reported feeling less guilty, and then ate less during the "taste test" than those who did not receive this prime. Their findings suggest that self-compassion can help reduce disinhibited eating that often occurs after diet breaking and can trigger binge eating episodes.

The current study sought to extend Alan and Leary's (2007) study by investigating the causal role of self-compassion and self-critical rumination as a response style to a negative event (false feedback relating to academic failure) on binge eating behaviour.

We hypothesised that participants instructed to respond to apparent failure with self-compassion would feel more soothed and comforted, which would be

reflected in increased positive affect and parasympathetic responding. It was additionally predicted that self-compassion instructions would be associated with less desire to eat and fewer calories consumed during a taste test. In contrast, those instructed to respond with a self-critical rumination were predicted to remain threat focused, as reflected by increased sympathetic responding, and would consequently experience an increased desire to eat, increased physiological reactivity to food, and they would therefore be more likely to overeat. Parasympathetic and sympathetic responding was measured using a physiological recording of heart rate variability.

Method

Participants

Participants were recruited through advertising the study on the website of eating disorder charity, 'Beat', and websites specifically for research recruitment, 'Call for Participants' and 'SONAS'; and an email announcement to all students who had accessed the university eating disorder support groups. The study was also advertised through posters at the university and surrounding gym facilities (see Appendix A for advertising materials).

Eligibility was assessed via an initial telephone screen. Women aged between 18 and 50 years old, with a body mass index (BMI) between 18.5 and 30kg/m², who met DSM-5 criteria for BED and BN (APA, 2013), and were fluent in English were included in the study. Diagnostic status was determined by administering the bulimic episodes, binge eating disorder and use of compensatory behaviours modules of the Eating Disorder Examination Interview (EDE; Fairburn, Cooper, O'Connor, 2008). Exclusion criteria were: 1) current pregnancy or breast-feeding, 2) current alcohol/drug abuse or dependency, 3) current or history of cardiovascular

complications, and 4) self-reported current severe mental health problems including psychosis, bipolar disorder and post-traumatic stress disorder.

Of the 172 people who expressed initial interest in the study, 123 attended a telephone screen and 71 fulfilled the eligibility criteria. Of these, 63 attended the experimental session and were randomised to either the compassion or self-critical rumination condition according to a randomisation code generated from the website www.random.org. Three participants were unable to complete the experiment due to an equipment malfunction, a fire alarm during testing and one participant became distressed during the rumination induction. As such, the statistical analysis was based on a total sample of $n=60$ (see Figure 2 for recruitment flowchart). All participants received a payment of £10 for their time. Recruitment and data collection took place between July 2016 and October 2016.

The sample size was informed by Adam and Leary (2007) and Svaldi and colleagues' (2014) studies. Adam and Leary measured the amount of food people consumed after being primed to think self-compassionately about eating a preload of food compared to those who received no prime. They found a difference in food consumption of large effect size ($d=1.17$). Svaldi and colleagues explored the effects of different emotion regulation strategies (reappraisal versus suppression) following a negative mood induction on calorie intake among women with BED (Svaldi, Tuschen-Caffier, Trentowska, Caffier, & Naumann, 2014). They found a significant effect of strategy on calorie intake of medium effect size ($d=0.52$). Based on the average effect size of the two studies, a power calculation using G*Power3 software (Faul, Erdfelder, Lang, & Buchner, 2007) determined that a minimum sample size of $n=60$ (30 per group) would be sufficient to detect a significant ($\alpha=0.05$) between group effect with power set at 0.80.

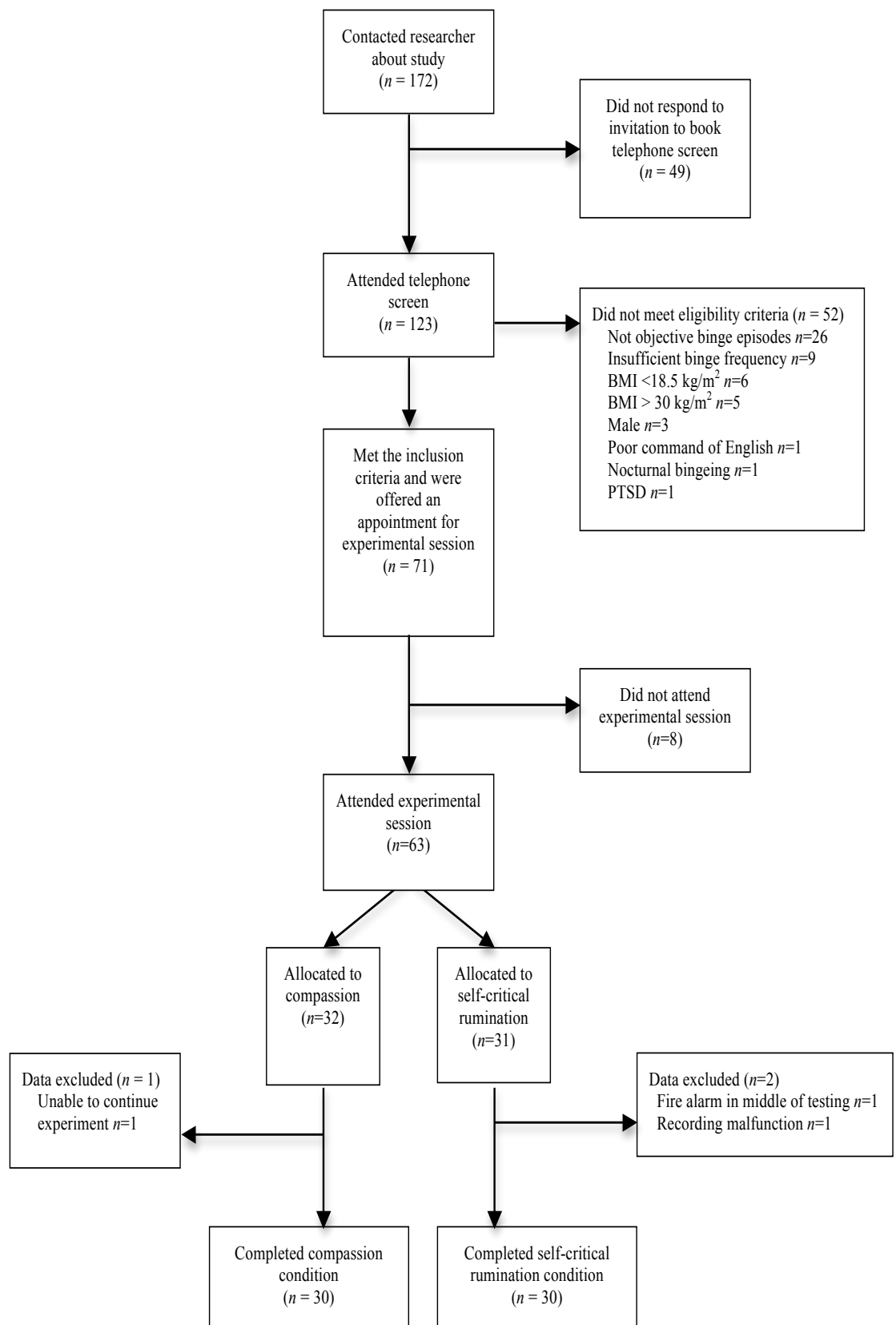


Figure 2: Recruitment flowchart

Measures

Subjective state measures

Positive and negative affect: Positive and negative affect was measured using the 10-item short-form version of the Positive and Negative Affect Schedule (PANAS-SF; Thompson, 2007). This self-report scale requires participants to rate how strongly they experienced a range of positive and negative emotions on a 5-point Likert scale (1=not at all, 5=very much so). The instructions were modified to ask participants to rate how they felt at that given moment in time. Higher scores on the positive subscale reflect higher levels of positive emotions and higher scores on the negative subscale reflect higher negative emotions. The short-form version of the PANAS has been shown to have reasonable internal reliability and validity (Thompson, 2007). Affect was also measured using the Types of Positive Affect Scale (TPAS; Gilbert et al., 2008). This assesses the extent to which people experience 18 different types of positive affect, which are summed to form three types of positive affect: Active Affect (e.g. energetic), Relaxed Affect (e.g. calm) and Safe Affect (e.g. secure). Participants were instructed to rate these items on a 5-point Likert scale (1=not at all, 5=very much so) again according to how they felt at that given moment in time. The authors report good internal consistency for each subscale (Cronbach's $\alpha = .73-.83$; Gilbert et al., 2008).

State self-compassion and self-criticism: The State Self-Compassion and Self-Criticism Scale (SCCS; Falconer, King, & Brewin, 2015) consists of five scenarios that can elicit varying degrees of self-compassion and self-criticism (e.g. "You arrive home to find that you left your keys at work"). Participants are instructed to imagine these scenarios, as vividly as possible, as if they are occurring at that current moment. After imagining each scenario participants are asked to rate,

using a 7-point Likert Scale (1=not at all to 7=highly), the extent to which they would react to themselves in a soothing, reassuring, compassionate, or harsh, contemptuous and critical manner. The items are summed to form a state self-compassion and self-criticism score. Scores can range between 15-105, with higher scores indicating more self-compassion and self-criticism respectively. The scale has good internal reliability and convergent validity (Falconer et al., 2015). It has also been shown to be sensitive to change in repeated measures designs that examine the effects of short periods of experimentally induced self-compassion (Falconer et al., 2014; Kamboj et al., 2015).

Self-reported desire to eat: Desire to eat was assessed using the following question, “At this moment in time how much do you want to eat something?” which was rated using a 100mm visual analogue scale (VAS), with 0 referring to “not at all” and 100 referring to “very much”.

Baseline hunger: A 100mm VAS was used to measure baseline self-reported hunger from 0 indicating “not at all” to 100 indicating “extremely”.

Trait measures

Eating disorder symptoms: The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 2008) is a self-report questionnaire that provides information about the frequency and severity of eating disorder-related symptomology over the past 28 days. It yields four subscales: Restraint, Eating Concern, Weight Concern and Shape Concern, and a Global score, which is an average of the four subscales. The global and subscale scores range from 0 to 6, with higher scores indicating greater symptom frequency and/or severity. The EDE-Q has good test-retest reliability, internal consistency and validity (Berg, Peterson, Frazier,

& Crow, 2012). The community norm for the Global EDE-Q for women is 1.55 (SD=1.21) (Fairburn & Beglin, 2008). The Global EDE-Q norm for patients with BN accessing eating disorder outpatient services is 4.45 (SD=1.11) and 4.07 (SD=0.82) for patients with BED (Brewin, Baggott, Dugard, & Arcelus, 2014).

Trait self-criticism: The Forms of Self-Criticising/Attacking and Self-Reassuring Scale (FSCRS; Gilbert et al., 2004) was used to measure participants' dispositional tendency towards self-criticism and self-reassurance. This scale consists of 22 statements, which are rated using a 5-point Likert scale according to how true they are of the person (1=not at all like me; 5=extremely like me). The questionnaire comprises of three scales: Inadequate Self, which is measured by statements such as "I am easily disappointed with myself" and "there is a part of me that feels I am not good enough"; Hated Self, which includes statements measuring sense of dislike towards oneself (e.g. "I have a sense of disgust with myself"), and Reassuring Self, which measures tendencies to be kind, supportive and forgiving to oneself (e.g. "I am gentle and supportive with myself"). The three subscales of the FSCRS have been shown to have good reliability (Baiao, Gilbert, McEwan, & Carvalho, 2015).

Depression: The Beck Depression Inventory-II (BDI-II; Beck, Steer & Brown, 1996) consists of 22 questions that assess the degree of depressive symptoms, including affective, cognitive, behavioural and physical symptoms of depression. Higher scores on this scale reflect more severe symptoms of depression. The reliability and validity of the BDI-II is well established (Wang & Gorenstein, 2013).

Strategy response compliance. Compliance with the self-compassion and self-critical rumination response strategy instructions was measured by asking

participants to answer the following question, “During the last exercise, please indicate the extent you were able to think about each statement by marking a cross on the following scale”, using a 100m VAS that was anchored with “Did not spend any time thinking about what was said” and “Spent 100% of the time thinking about what was being said”.

Physiological measures

Heart rate variability: The ratio of low frequency (LF) to high frequency (HF) components of heart rate variability (HRV) was used as a proxy marker of cardiovascular autonomic regulation. HRV was obtained using an electrocardiogram (ECG) device with a sampling rate of 1 kHz (Bodyguard 2, FirstBeat Technologies, Jyväskylä, Finland). The ECG device was attached to participants using two electrodes, with one attached below the right collarbone and the other at the bottom of the left ribcage. The ratio of LF/HF HRV was derived using the Kubios software package (Tarvainen, Niskanen, Lipponen, Ranta-Aho, & Karjalainen, 2014). The HF (0.18-0.4 Hz) component of HRV is widely accepted to reflect cardiac parasympathetic nervous activity, while the low frequency component (0.04 to 0.15 Hz) is generally assumed to represent sympathetic responding (Task Force of the European Society of Cardiology, 1996). Thus the ratio of LF to HF is used to quantify the changing relationship between sympathetic and parasympathetic activity, with increases in the LF to HF ratio reflecting a shift to sympathetic dominance. A decrease in this index corresponds to parasympathetic dominance (Pagani et al., 1984, 1986).

Stimulus Materials

Negative mood induction procedure. The negative mood induction procedure was the failure version of the Remote Associates Test (RAT; McFarlin & Blascovich, 1984). This requires participants to solve 10 problems, each of which involves finding a word that relates to three presented words (e.g. “box” to the set of words “soap–shoe-tissue”) in five minutes. Items in the failure version are solvable but designed to be so difficult that people are unlikely to be able to identify the link word, and on average only one problem is answered correctly. This failure to complete the task reliably induces negative mood (Brown & Dutton, 1995). To enhance the induction, after completion of the test the researcher marked three of the answers as correct and gave standardized feedback, “on average people get five right, ok so you managed to get three right”. Participants were also informed prior to taking the test that the test assesses verbal reasoning ability, a component of IQ that is highly correlated with academic achievement.

Self-compassion and self-critical rumination response strategy instructions. Instructions designed to induce self-compassion and self-critical ruminative response styles were audio recorded by the first author in a sound attenuated environment. The instructions for cultivating self-compassion were based on Kristin Neff’s mindful self-compassion guided meditation. This is available at <http://self-compassion.org>. This guided meditation is a core practice in the 8-week mindful self-compassion group intervention developed by Neff and Germer (2013). The meditation focuses on cultivating self-compassion by encouraging one to 1) show oneself kindness and understanding instead of criticism and self-judgment; 2) to see one’s pain, suffering and imperfections as common to humanity rather than

isolating; and 3) to be mindful of one's feelings and thoughts instead of over identifying with them.

To induce a self-critical ruminative response style, an adaption of the internationally adopted paradigm for inducing rumination, developed by Nolen-Hoeksema and Morrow (1993), was used. This involved following instructions to think about a series of questions that are judgmental and ruminative in nature, in that they foster repetitive evaluations about aspects of the self and symptoms of distress.

The two response strategies were matched in terms of duration of the recordings (10 minutes), number of words (self-compassion $n=678$; self-critical rumination $n=686$) and complexity of language (Flesch-Kincaid grade level 6.9 for both recordings; Kincaid, Fishburne, Rogers, & Chissom, 1975). Ten trainee Clinical Psychologists reviewed the content of each strategy. They also completed the PANAS-SF and SCCS prior to and after each recording, and gave verbal feedback about their experience of the strategy instructions. The piloting showed that the two response strategies had differential effects on state self-compassion, self-criticism and mood, with the self-compassion instructions effectively increasing state self-compassion and positive mood. In contrast, the self-critical rumination instructions had no effect on levels of self-compassion but increased levels of state self-criticism and negative mood.

In vivo cue-reactivity procedure. Reactivity to food was assessed by positioning three bowls of food, one with Cadbury's milk chocolate buttons, another with blueberry muffins and the third with Maryland chocolate chip cookies, each weighing 50 grams, in front of the participants. Participants were then given standardised verbal instructions of how to interact with the food. Participants were

asked to “focus their attention on the smell of the food and how it appears, without touching or tasting it”. After 5 minutes participants were asked to indicate on a 0-100mm VAS ‘At this moment in time how much do you want the chocolate/cake/biscuits?’ in addition to ‘At this moment in time how pleasant do you think the chocolate/cake/biscuits tastes?’ The scales were anchored with “not at all” and “very much so”. Participants were then asked to sample each of the foods and to rate how pleasant each of the foods tasted using the 100mm VAS. Participants were instructed to eat as much or as little as they wanted to make their ratings. Once participants had finished eating and completed their ratings they were asked again to indicate, “At this moment in time how much do you want the cookies/chocolate/cake?”

Ad libitum food intake. Following the cue reactivity paradigm participants were told that they could eat as much of the leftover food as they wanted because the food would have to be disposed of for health and safety reasons. They were also told that they would not be able to take any food away with them again for health and safety reasons. After one minute the researcher told the participant that they needed to go and check on the next participant, and the current participant was left alone in the room with the food for five minutes. Once the participant had left, the remaining food was weighed to calculate the amount consumed.

Design and Procedure

A between-subjects experimental design was used, with participants randomly allocated to the compassion or self-critical rumination condition at the point of attending the experimental session.

Participants were instructed to not eat, drink any alcoholic or caffeinated drinks, or engage in strenuous exercise for three hours prior to the experiment. They were also asked to refrain from smoking for an hour before the experiment. These guidelines were given to control for hunger and the effects of these factors on heart rate variability (Karakaya et al., 2007; Lima et al., 2011; Notarius, Morris, & Floras, 2006).

Testing sessions were conducted individually in a quiet laboratory room at the university. Upon arrival at the experimental session, all participants were given an information sheet about the stages of the experiment. This also included a cover story that stated the researcher was interested in exploring the relationship between verbal reasoning abilities, thinking styles, mood, heart rate activity and food preferences. Participants were then invited to provide written consent (copies of the information sheet and consent form can be found in Appendices B and C, respectively). Participants then completed the following baseline questionnaires and self-report measures (EDE-Q, BDI-II, FSCRS, and baseline hunger). They also completed state measures of affect (PANAS-SF, TPAS), self-compassion and self-criticism (SCCS), and desire to eat at this time point (T1-baseline).

Participants were then fitted with the ECG equipment and their HRV was measured during an initial 5-minute baseline period and throughout the rest of the experiment. After the baseline measure of HRV, participants completed the negative mood induction task (the failure version of the Remote Associates Test), followed by the compassion or self-critical ruminative response strategy. Affect, state self-compassion and self-criticism, and desire to eat were assessed again after the negative mood induction (T2) and after the compassion/self-critical ruminative response strategy (T3). Following the response strategy manipulation, participants

were required to rate the extent they had complied with the instructions. This was followed by the cue-reactivity procedure and ad libitum food intake. The entire procedure is depicted in Figure 3.

After the experiment participants were fully debriefed about the purpose of the experiment and were given £10 for their participation. Participants in both conditions were also given a copy of the compassion recording.

Ethics

Ethical approval for the study was obtained from the University College London Graduate School Research Ethics Committee (Project ID number 7965/001, see Appendix D). The main ethical considerations were the use of deception about the purpose of the experiment and the consequent implications for informed consent, as well as the potential distress the negative mood induction and critical rumination response strategy could cause. To help manage this, participants were informed of their right to withdraw from the experiment at any stage without penalty. Participants were also fully debriefed about the aims of the experiment and the real purpose of the Remote Associates Test. The researcher also checked with all participants how they felt during the debrief and participants in both conditions were offered a copy of the recording of the compassion induction. The telephone screen and questionnaires also asked participants potentially sensitive information about their eating behaviour and thoughts and feelings with regard to their weight, shape and eating. To help manage this, this information was handled sensitively and compassionately and

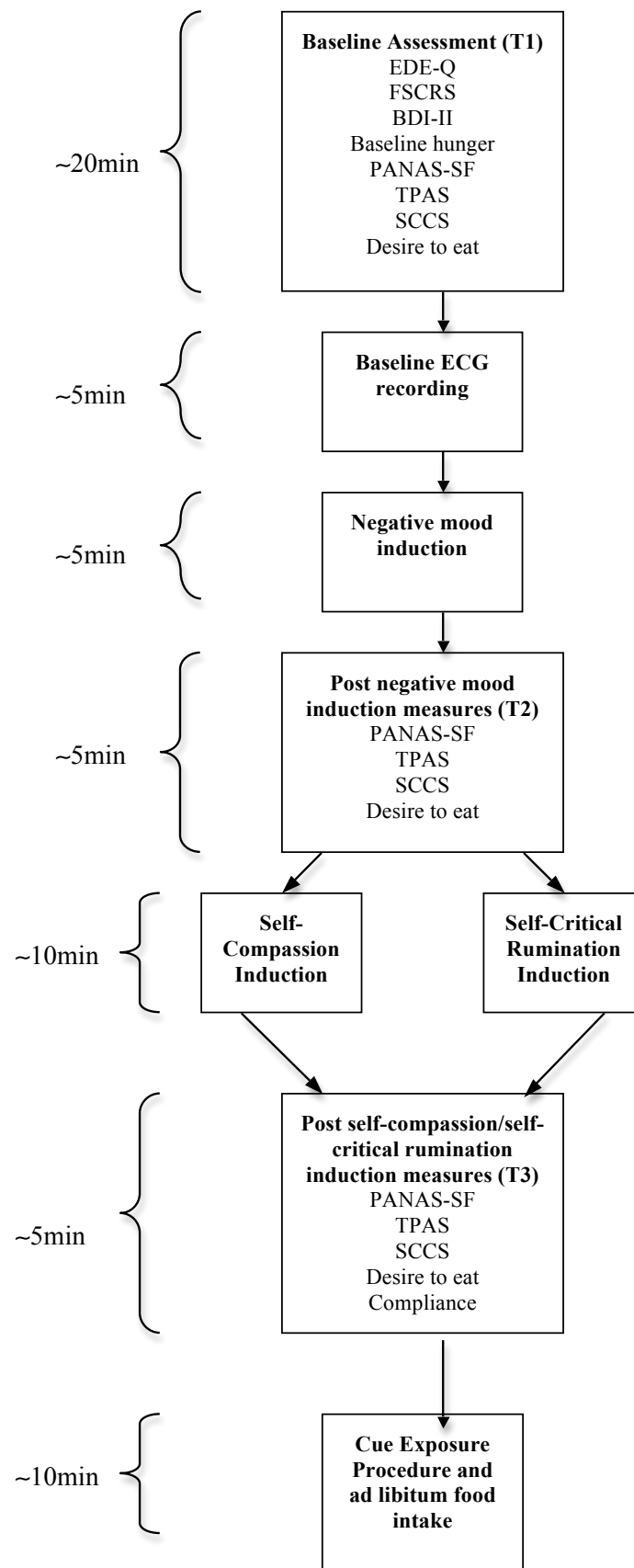


Figure 3: Timeline of experimental procedure

participants were informed that they did not have to answer any questions they did not feel comfortable with. Data was also anonymised and kept confidential, and was stored in a secure setting in line with the Data Protection Act 1998. Participants were informed of this and of how their data would be used.

Statistical Analyses

Data was examined and assessed for adherence to assumptions underlying parametric testing. To assess whether the variables of interest were normally distributed, Kolmogorov-Smirnov values and the significance of skewness were calculated and histograms of the distributions were visually inspected. Data that was significantly skewed was transformed using the square root transformation. Where the assumption of equality of variances was violated, t-tests not assuming homogeneity of variance were computed and adjusted degrees of freedom reported. Outliers, defined as z-scores >3 , were replaced with scores equivalent to three standard deviations from the mean (Field, 2013).

The groups were compared according to demographic characteristics, trait measures, eating disorder symptoms, baseline hunger, cue-reactivity measures and amount of food eaten, using independent sample t-tests or chi-square/fisher's exact tests for categorical data. The main outcomes were analysed using mixed 2 x 3 ANOVAs with Response Strategy (self-compassion vs self-critical rumination) as the between-subjects variable and Time (T1 (baseline), T2 (after negative mood induction), T3 (after response strategy) as the within-subject variable.

The effects of Response Strategy (self-compassion vs self-critical rumination) on cue-reactivity and food consumption for each of the foods (chocolate, biscuits, muffin), and across food types, were analysed. The level of significance and effects

were similar for both sets of analyses. Thus, for simplicity analyses of the combined data will only be reported.

The significance level was set at 0.05 and all reported tests are two-tailed. Pairwise comparisons, which were Bonferonni corrected, were used for post-hoc analyses. Dependent, within-group effect sizes were calculated using Dunlap and colleagues' formula, based on t and r values of within subjects tests (Dunlap, Cortina, Vaslo, & Burke, 1996).

Results

Sample Characteristics and Baseline Analyses

57% of participants met DSM-5 criteria for BED and 43% for BN (APA, 2013). The average age of participants was 25.8 years old ($SD=6.4$ years) and the majority were students (53%). Baseline characteristics of participants in the two groups are presented in Table 3. There were no significant differences between groups on any of the sociodemographic variables, binge eating frequency, use of compensatory behaviours, BMI, severity of depression, trait self-criticism or baseline hunger. See Table 3 for group comparisons for these variables at baseline.

Compliance with Response Strategy Instructions

The compliance with strategy instructions did not differ between groups and was relatively high in both conditions (self-compassion: $M=72.87\%$, $SD=14.13$; self-critical rumination: $M=72.03\%$, $SD=17.04$; $t(58)=0.206$, $p=0.84$).

Table 3

Characteristics of sample and baseline comparisons between self-compassion and self-critical rumination groups

Characteristic	Self-Compassion (<i>n</i> =30)	Self-Critical Rumination (<i>n</i> =30)	Total sample (<i>n</i> =60)	Significance
Age (years), mean (SD)	26.8 (6.78)	24.8 (5.60)	25.8 (6.42)	<i>t</i> (58)=1.21, <i>p</i> =0.231
BMI (kg/m ²), mean (SD)	24.0 (3.87)	23.8 (3.15)	23.9 (3.50)	<i>t</i> (58)=0.21, <i>p</i> =0.838
Ethnicity, <i>n</i> (%)				
Caucasian	16 (53.3%)	14 (46.7%)	30 (50.0%)	Fisher's exact <i>p</i> =0.954
East Asian	5 (16.7%)	6 (20.0%)	11 (18.3%)	
Southern Asian	3 (10.0%)	5 (16.7%)	8 (13.3%)	
African/Caribbean	3 (10.0%)	2 (6.7%)	5 (8.3%)	
Multiracial	3 (10.0%)	3 (10.0%)	6 (10.0%)	
Employment status, <i>n</i> (%)				
Employed part or full-time	11 (36.7%)	11 (36.7%)	22 (36.7%)	Fisher's exact <i>p</i> =0.805
Student	17 (57.7%)	15 (50.0%)	32 (53.3%)	
Unemployed	2 (6.7%)	4 (13.3%)	6 (10.0%)	
Years of education (SD)	15.93(2.16)	15.53 (1.74)	15.73 (1.96)	<i>t</i> (58)=0.79, <i>p</i> =0.433
Diagnosis, <i>n</i> (%)				
BED	16 (53.3%)	18 (60.0%)	34(56.7%)	χ^2 (1)=0.27, <i>p</i> =0.795
BN	14 (46.7%)	12 (40.0%)	26 (43.3%)	
OBE in last 28 days, mean (SD)	11.8 (10.44)	10.7 (6.42)	11.3 (8.61)	<i>t</i> (58)=0.48, <i>p</i> =0.630
Use of compensatory behaviours in last 28 days, <i>n</i> (%)				
Vomiting	7 (23.3%)	3 (15.0%)	10 (16.7%)	Fisher's exact <i>p</i> =0.299
Laxative misuse	5 (16.7%)	1 (3.3%)	6 (10.0%)	
Excessive Exercise	18 (60.0%)	17 (56.7%)	35 (58.3%)	
Extreme Dietary Restriction	16 (53.0%)	13 (43.3%)	29 (48.3%)	
BDI-II, mean (SD)	21.50 (14.75)	16.40 (7.46)	18.95 (11.87)	<i>t</i> (58)=1.69, <i>p</i> =0.096
FSCRS, mean (SD)				
FSCRS Inadequate Self	24.33 (8.92)	22.50 (7.25)	23.42 (8.11)	<i>t</i> (58)=0.87, <i>p</i> =0.386
FSCRS Hated Self	7.20 (5.50)	5.20 (3.81)	6.20 (4.80)	<i>t</i> (58)=1.64, <i>p</i> =0.107
FSCRS Reassuring Self	15.57 (7.05)	16.23 (6.85)	15.90 (6.90)	<i>t</i> (58)=-0.37, <i>p</i> =0.712
EDEQ, mean (SD)				
EDEQ Global Score	3.30 (1.25)	2.98 (1.16)	3.14 (6.42)	<i>t</i> (58)=1.03, <i>p</i> =0.309
EDEQ Restraint	2.56 (1.65)	2.23 (1.47)	2.40 (1.21)	<i>t</i> (58)=0.81, <i>p</i> =0.422
EDEQ Eating Concerns	3.05 (1.13)	2.53 (1.21)	2.79 (1.29)	<i>t</i> (58)=1.58, <i>p</i> =0.120
EDEQ Shape Concerns	3.92 (1.39)	3.75 (1.37)	3.84 (1.37)	<i>t</i> (58)=0.47, <i>p</i> =0.643
EDEQ-Weight Concerns	3.65 (1.58)	3.39 (1.31)	3.52 (1.44)	<i>t</i> (58)=0.71, <i>p</i> =0.479
Baseline Hunger	49.10 (26.89)	58.40 (29.50)	53.75 (28.34)	<i>t</i> (58)=-1.28, <i>p</i> =0.207

Note. BDI-II=Beck Depression Inventory II, BED=Binge Eating Disorder; BMI= Body Mass Index; BN=Bulimia Nervosa, EDE-Q=Eating Disorder Examination Questionnaire; FSCRS=Forms of Self-Criticising/Attacking and Self-Reassuring Scale; OBE=Objective Binge Episodes; SD=standard deviation

Mood deterioration and recovery: effects of negative mood induction and response strategy

Positive affect: There was a main effect of Time on the ‘active’, ‘relaxed’ and ‘safe’ subscale of the TPAS (F values ≥ 23.71 , p values <0.001 , η_p^2 values ≥ 0.29); and for the positive affect subscale of the PANAS ($F(2,116)=12.93$, $p=0.01$, $\eta_p^2=0.18$). There was also a main effect of Response Strategy for active ($F(1,58)=5.65$, $p=0.021$, $\eta_p^2=0.09$) and positive affect ($F(1,58)=5.66$, $p=0.02$, $\eta_p^2=0.09$). These effects were qualified by significant Time x Response Strategy interactions for relaxed ($F(2,116)=7.81$, $p=0.001$, $\eta_p^2=0.12$) and safe affect ($F(2,116)=4.08$, $p=0.019$, $\eta_p^2=0.07$).

As can be seen from Figure 4, participants in the compassion condition reported greater active and positive mood states across all three time points. Post hoc tests revealed a significant deterioration in active and positive affect from T1 to T2 (p values <0.001 , d values ≥ 0.69) to a similar degree in both conditions, suggesting that the negative mood induction procedure was effective in reducing positive and active affect. There was no significant change in active or positive affect between T2 and T3 for both groups (p value ≥ 0.7 , d values < 0.05).

Similarly, post hoc tests revealed a significant deterioration in relaxed and safe affect from T1 and T2 for both groups (p values <0.001 , d values >0.60) again consistent with an effective negative mood induction (Figure 4). However, a twofold larger increase in relaxed and safe affect from T2 to T3 occurred in the compassion group (relaxed affect: $p<0.001$, $d=1.31$; safe affect $p<0.001$, $d=0.88$) relative to the self-critical rumination group (relaxed affect: $p=0.05$, $d=0.67$; safe affect $p=0.06$, $d=0.41$). This suggests that the compassion induction was associated with a greater increase in relaxed and safe affect than the rumination induction.

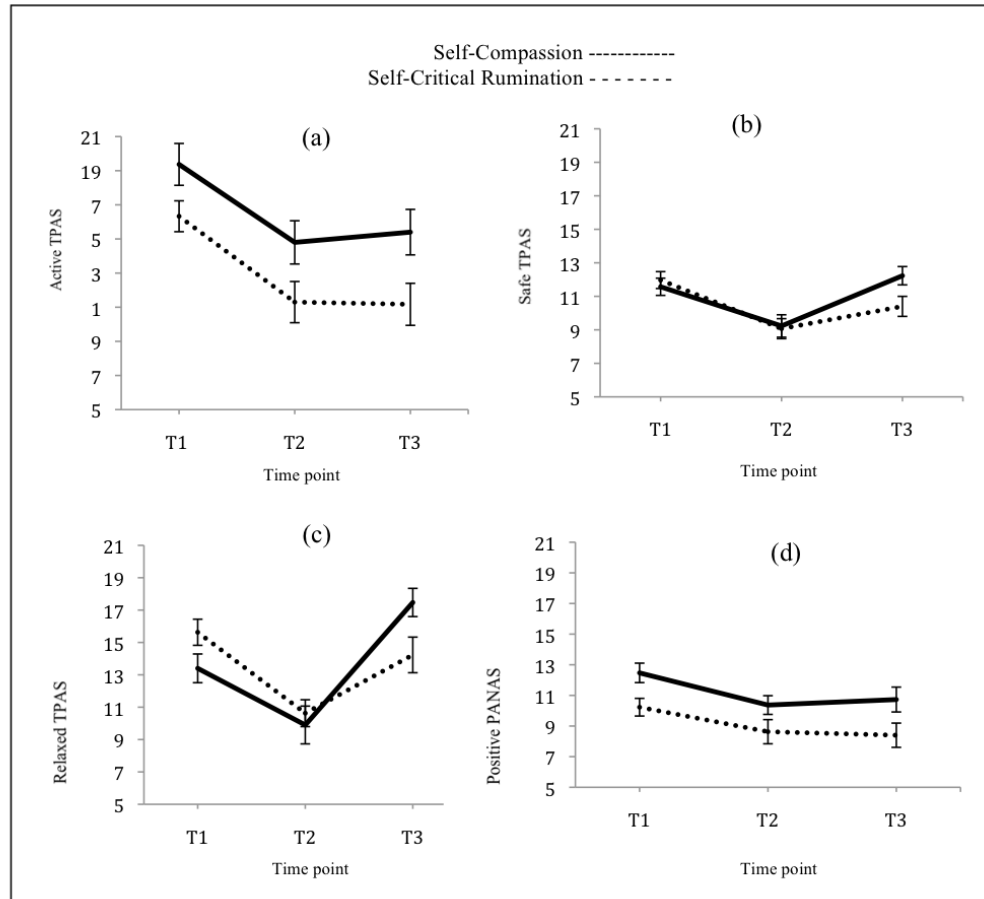


Figure 4: Mean \pm SEM positive affect scores at three within-session time points (baseline (T1), post negative mood induction (T2) & post response strategy (T3)). (a) Active affect, (b) Safe affect, (c) Relaxed affect and (d) Positive affect.

Negative affect: There was a main effect of Time ($F(2,116)=19.57$, $p<0.001$, $\eta_p^2=0.18$) and a Time x Response Strategy interaction ($F(2,116)=3.53$, $p=0.032$, $\eta_p^2=0.057$) on the negative affect subscale of the PANAS (Figure 5). This interaction reflected a similar significant increase in negative affect from T1 to T2 for both groups (p values ≤ 0.009 , d values ≥ 0.634) and a larger reduction in negative affect from T2 to T3 for the compassion group ($p<0.001$, $d=0.88$) relative to the self-critical rumination group ($p=0.59$, $d=0.24$).

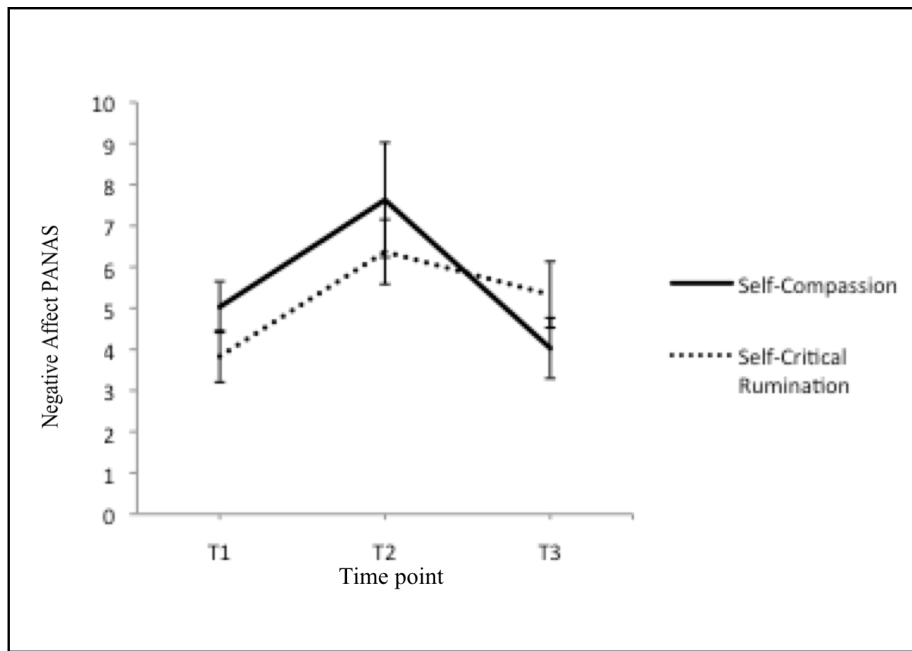


Figure 5: Mean \pm SEM negative affect scores (PANAS) at three within-session time points. Baseline (T1), post negative mood induction (T2), post response strategy (T3).

State self-criticism and self-compassion: There was also a main effect of Time ($F(2,116)=21.43$ $p<0.001$, $\eta_p^2=0.27$) and a Time x Response Strategy interaction $F(2,116)=6.36$, $p=0.032$, $\eta_p^2=0.10$) for the self-compassion scale of the SCCS. As can be seen in Figure 6, this interaction reflects a similar decrease in self-compassion from T1 to T2 for both groups (p values ≤ 0.015 , d values > 0.21) and a significant increase in self-compassion from T2 to T3 for the compassion group ($p<0.001$, $d=0.34$) relative to the self-critical rumination group ($p=0.052$, $d=0.22$).

There was also main effect of Time ($F(2,116)=42.95$, $p<0.001$, $\eta_p^2=0.43$) and a Time x Response Strategy interaction $F(2,116)=13.16$, $p<0.001$, $\eta_p^2=0.19$) on the self-criticism scale of the SCCS. As can be seen in Figure 6, this interaction reflects no difference in self-criticism from T1 to T2 for both groups (p values = 1, d values ≤ 0.007) and a three times larger reduction in self-criticism from T2 to T3 for the compassion group ($d=0.89$, $p<0.001$) relative to the self-critical rumination group

($d=0.29$, $p=0.018$). Means and standard deviations of mood states and state self-compassion and self-criticism at each time point can be found in Appendix E.

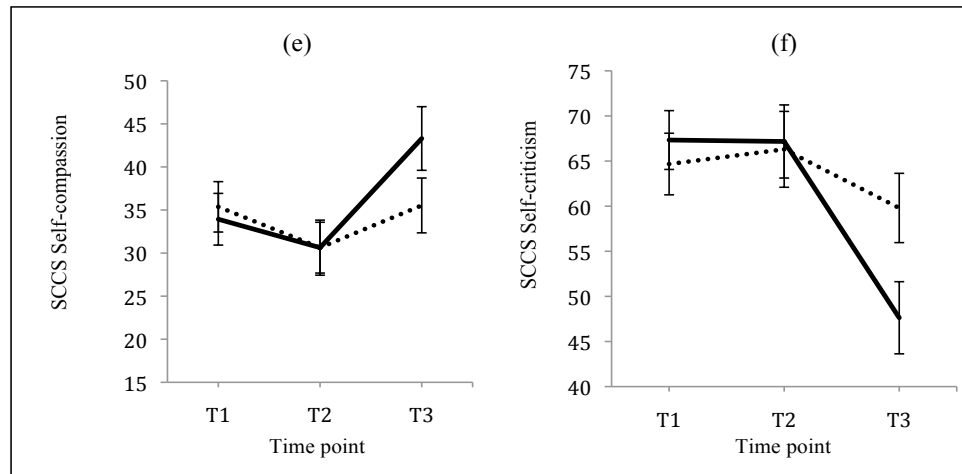


Figure 6: Mean \pm SEM self-compassion (e) and self-criticism scores (f) at three within-session time points. Baseline (T1), post negative mood induction (T2) & post response strategy (T3).

Heart Rate Variability. Parasympathetic activity, indexed using the ratio of LF to HF HRV showed a main effect of Time ($F(2,112)=10.54$, $p<0.001$, $\eta_p^2=0.16$). No main effect of Response Strategy ($F(1,56)=0.21$, $p=0.65$, $\eta_p^2=0.004$) or significant interaction between Response Strategy and Time were found ($F(2,112)=1.09$, $p=0.34$, $\eta_p^2=0.019$). Post hoc tests showed a significant increase in sympathetic relative to parasympathetic responding from T1 to T2 ($p<0.01$) and no significant change from T2 to T3 ($p=0.38$) for both groups (see Figure 7).

Effects of Mood and Response Strategy on Desire to Eat

No main effects of Time or Response Strategy or significant interactions were found for desire to eat (F values <2.93 , $p>0.05$).

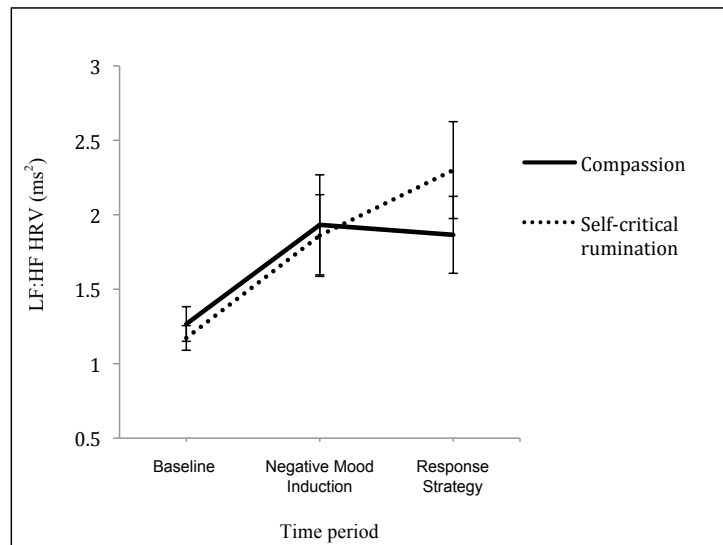


Figure 7: Mean \pm SEM low frequency to high frequency HRV ratio during three within-session time periods.

Effects of Response Strategy on Cue-Reactivity and Food Intake

Cue-triggered “Wanting” and “Liking” of food and physiological reactivity: There were no significant differences between the self-compassion and self-critical rumination groups according to how much they reported they wanted to eat the food ($t(58)=-1.50$, $p=0.139$), how pleasant they anticipated the food would taste ($t(58)=-0.13$, $p=0.896$) or in terms of physiological reactivity to food ($t(56)=-0.70$, $p=0.486$) after food cue exposure and prior to tasting the foods.

In total 7 participants refused to taste the food (compassion $n=4$, rumination $n=3$)¹. Analyses based on the sample who tasted the food showed that participants in the self-critical rumination condition rated the food they ate as significantly more

¹ Reasons cited for food refusal were similar in both conditions and included fear of triggering a binge eating episode and allergies.

pleasant in taste ($M=70.25$, $SD=17.13$) than participants in the compassion condition ($M=56.15$, $SD=18.49$), ($t(51)=2.880$, $p=0.006$, $d=0.81$).

After tasting the food, participants in the self-critical rumination condition rated the degree they wanted to eat more of the food as significantly higher ($M=58.14$, $SD=24.41$) than those in the compassion condition ($M=40.18$, $SD=18.63$), ($t(51)=2.15$, $p=0.036$, $d=0.56$).

Ad Libitum Food intake

Participants in the self-compassion condition consumed significantly fewer calories ($M=161.74$, $SD=114.38$) than the self-critical rumination group ($M=305.92$, $SD=155.00$), $t(46.49)=-3.86$, $p<0.001$, $d=1.27$ (See Figure 8).

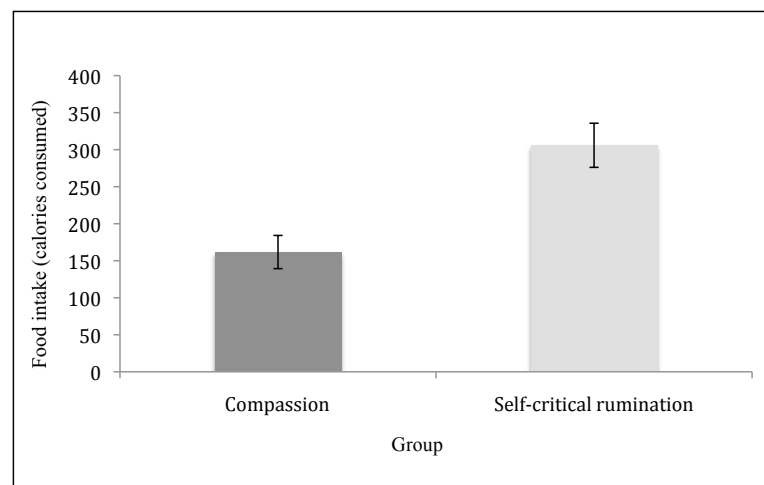


Figure 8: Mean \pm SEM of calories consumed in each condition

Discussion

The aim of the current study was to examine the effects of self-compassion and self-critical rumination, following a negative mood induction, on cravings to eat, affect and food consumption, in women with BED and BN. The primary findings

were that participants in the self-compassion condition rated the food they consumed as part of the experimental ‘taste test’ as less pleasurable, consumed significantly fewer calories and reported less desire to continue eating, compared to the self-critical rumination group. Contrary to predictions however, negative mood induction (while effectively decreasing positive affect and increasing negative affect and sympathetic responding), did not lead to increased self-reported cravings to eat. Similarly, although the self-compassion response strategy resulted in greater recovery in positive and negative affect and levels of state self-compassion and self-criticism, this did not lead to differences in self-reported cravings or physiological reactivity to food prior to the taste test.

The finding that increased negative mood did not lead to increased cravings to eat is inconsistent with previous research. Previous studies have reliably found that the induction of negative mood, among individuals with BED and BN, leads to increased self-reported cravings to eat (Svaldi, Caffier, & Tuschen-Caffier, 2010; Waters, Hill, & Waller, 2001), increased physiological reactivity to food cues (Laberg, Wilson, Eldredge, & Nordby, 1991), and greater activity in the brain regions subserving the rewarding value of appetitive stimuli (Wagner, Boswell, Kelley, & Heatherton, 2012).

In the current study, a significant difference in self-reported cravings was only found after the participants had tasted the food. Self-reported cravings to eat at this stage were positively associated with the amount of food consumed. Physiological reactivity after participants had tasted the food was not measured. Therefore it cannot be concluded whether the differences in self-reported cravings were reflected in changes in physiological reactivity.

It is commonly reported that although some binge episodes are premeditated, binge eating often occurs automatically in response to eating a “trigger” food (Fairburn, 2008). Trigger foods tend to be foods that the person is actively trying to avoid eating, such as those high in calories and fat content. This phenomenon has frequently been demonstrated in laboratory experiments. Paradoxically, individuals who restrict their food intake tend to eat more after a preload of forbidden foods than in the absence of a preload. In comparison, non-restrained eaters will eat less in response to a preload of highly palatable food (Herman & Mack, 1975; Herman & Polivy, 2004). This “disinhibition effect” or “counter-regulation” effect is a cognitive process, as it depends on the meaning attached to eating certain foods, and the associated affect, that results in the dysregulation of eating behaviour (Cooper, Todd and Wells, 2000; Fairburn, Cooper, & Shafran, 2003). People who oscillate between restrictive eating and binge eating episodes tend to interpret eating personally “forbidden” foods in a catastrophic and dichotomous way, believing they have failed at their diet. Consequently, they can temporarily abandon efforts to restrict dietary intake and as a result, binge eat (Fairburn et al., 2003). Alternatively, they overeat as a means of escaping the negative thoughts and emotions associated with breaking their diet (Herman & Polivy, 2004).

The findings that self-reported cravings to eat and ratings of pleasantness of food only after tasting the foods were associated with amount of food eaten support the disinhibition effect. However, they also implicate the role of cravings and the hedonic experience of eating as contributing to this effect.

The results that the self-compassion strategy reduced food cravings after the preload and total food consumption, are consistent with Adam and Leary’s (2007) study findings, which showed that promoting self-compassionate attitudes toward

eating among restrictive and guilty eaters reduced disinhibited eating. However, the current study adds to the findings as it suggests that relating to oneself with compassion in the face of failure and distress in general can help individuals who are prone to lose control of their eating regulate their eating behaviour.

‘Fear of self-compassion’ among binge eaters often entails a belief that a kind non-critical response to diet failure is a sign of self-indulgence and weakness (Cooper et al., 2000). This is often accompanied by a belief that harsh self-criticism and punishment will motivate the individual to adhere to personal goals (Gilbert et al., 2004). This study confirms that these beliefs are counterproductive. The results add to the body of literature showing that self-affiliative attitudes can in fact improve self-regulation of behaviours. Baumeister and Vohns (2004) define self-regulation as an effortful process, whereby individuals override impulses to enable them to engage in behaviours that are more consistent with overarching goals. Increasing evidence demonstrates an association between self-compassion and the self-regulation of behaviours in line with health goals. For example, self-compassion is positively associated with increased exercise (Magnus, Kowalski, & McHugh, 2010), smoking reduction (Kelly, Zuroff, Foa, & Gilbert, 2010) and moderate (rather than harmful) alcohol consumption (Brooks, Kay-Lambkia, Bowman & Childs, 2012). Self-compassion is also positively associated with goal reengagement and resilience when goals are not met (Hope, Koestner, & Milyavskaya, 2014).

Self-regulation, particularly with regards to eating, is often derailed by negative affect (Heatherton & Baumeister, 1991). Therefore adaptive management of negative affect is likely to result in improved self-regulation of behaviours. The findings from the current study support this. The current study showed that the self-compassion strategy resulted in greater recovery in negative and positive affect, as

well as state self-compassion and self-criticism. Thus self-compassion may help people who binge eat maintain control over eating behaviour through the regulation of negative affect.

Self-compassion could also promote an attitude of self-care that is necessary to fuel motivation for adaptive behavioural responses. On the other hand, self-criticism can trigger perceptions of worthlessness. This can undermine attempts to self-care, and instead promote the use of more punishing behavioural responses such as bingeing, purging or self-harm.

The finding that self-compassion reduced the ratings of pleasantness of food in comparison to the self-criticism strategy is novel, and has implications for understanding the mechanisms through which self-compassion can help people regulate their eating behaviour. It suggests that the experience of self-compassion and improved affect may reduce the relative rewarding hedonic value of food and therefore cravings to continue eating.

In the current study, the different response strategies were not associated with differences in heart rate variability. Previous findings from studies exploring the role of compassion on heart rate variability suggest that self-compassion is associated with increased parasympathetic responding (Duarte et al., 2015; Rockliff et al., 2008). However, these studies explored the role of compassionate imagery, which involved imagining receiving compassion from a compassionate other, whereas this study explored the cultivation of compassion through verbal processes. Mental imagery can be more powerful in stimulating various emotions and physiological states than verbal representations (Holmes & Matthews, 2010). The different methods of generating self-compassion may account for the different effects observed and this should be explored further.

The interpretation and generalisability of the current findings are limited by a number of factors. Firstly, the sample consisted of females only to control for differences amongst gender in self-reported cravings (Cepeda-Benito, Fernandez, & Moreno, 2003); and the majority were students with a mean age of 26 years old. Binge eating difficulties are particularly pervasive in this population, with studies finding up to 44% of female students report binge eating symptoms, while between 6-8% meet criteria for BED or BN (Napolitano & Himes, 2011; Saules et al., 2009). However, many people develop BED in midlife, and it is estimated that a third of sufferers are men (Beat, 2015; Hudson, Hiripi, Pope, & Kessler, 2007). In addition, most of the participants in the current study were normal weight or overweight rather than obese. This was because an exclusion criterion for this study was a BMI greater than 30 (to control for the effects of obesity on heart rate variability, Karason, Molgaard, Wikstrand, & Sjostrom, 1999). Although most women with BN and some individuals with BED are normal weight, most individuals meeting criteria for BED are likely to be overweight or obese (Bruce & Agras, 1992). Finally, whilst participants were screened, it was not possible to administer a full diagnostic clinical interview to confirm diagnosis. Thus the findings of this study may not be representative of the range of people who suffer with BED and BN.

In addition, although the ad libitum food intake was used as an approximation of ecological binge eating behaviour, it is not clear how valid this measure is. A defining feature of binge eating episodes is loss of control over eating (APA, 2013). As limited food was available and loss of control was not assessed, it cannot be concluded whether this subjective state occurred.

It is also likely that the experimental context influenced the amount eaten. Binge eating typically occurs in isolation because of the shame associated with the

behaviour (APA, 2013). Therefore it is likely that participants regulated their food intake to some extent in accordance with social desirability. Indeed, many participants in the critical rumination condition fed back that they would have eaten everything available and more if they had completed the experiment in the privacy of their own home. Furthermore, although the experimental procedure was designed so that participants were unaware that the researcher was interested in how much food they consumed, it is possible that they guessed this and regulated their behaviour in accordance with expectations. Although, the fact that there was a significant relationship between cravings to eat, ratings of pleasantness of food and amount eaten does provide some support for the validity of this task.

Also, in general, conclusions regarding the functionality of self-compassion and self-critical rumination have to be interpreted with caution due to lack of a no-strategy control condition. Without such a control, it is difficult to ascertain whether self-compassion has additional benefits or whether self-criticism was more dysfunctional than participants' natural response style.

The absence of a non-eating disordered control group also limits conclusions concerning whether the differential effect of self-compassion and self-criticism on eating behaviour is specific to women with BED and BN, or also occurs in people without eating difficulties.

To overcome some of the above limitations, it would have been informative to include a follow-up period during which participants were required to practice their allocated strategy when they felt low in mood. This would provide further evidence of the effects of self-compassion and self-criticism on binge eating behaviour in a more ecologically valid manner. Finally, blinding of the experimenter

or automation of the experimental procedure would increase confidence in the findings.

To conclude, self-compassion after a negative mood induction was associated with improved mood, a reduction in the rewarding hedonic value of food, reduced cravings to eat and reduced food consumption. This suggests that facilitating emotion regulation through the cultivation of self-compassion could help individuals with BED and BN self-regulate their eating behaviour. Further studies should explore whether this effect also occurs in men, and in people whose weight is within the obese range, with and without BED. The results of which could help inform weight management treatments, as well as treatments for eating disorders for a wider population.

References

- Adams, C. E., & Leary, M. R. (2007). Promoting self-compassionate attitudes toward eating among restrictive and guilty eaters. *Journal of Social and Clinical Psychology, 26*(10), 1120-1144.
- Agras, W. S., & Telch, C. F. (1998). The effects of caloric deprivation and negative affect on binge eating in obese binge-eating disordered women. *Behavior Therapy, 29*(3), 491-503. doi:10.1016/s0005-7894(98)80045-2
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: (5th ed.)* . Washington, DC: Author.
- Baiao, R., Gilbert, P., McEwan, K., & Carvalho, S. (2015). Forms of Self-Criticising/Attacking & Self-Reassuring Scale: Psychometric properties and normative study. *Psychology and Psychotherapy: Theory, Research and Practice, 88*(4), 438-452.

- Bartholdy, S., Dalton, B., O'Daly, O. G., Campbell, I. C., & Schmidt, U. (2016). A systematic review of the relationship between eating, weight and inhibitory control using the stop signal task. *Neuroscience and Biobehavioral Reviews*, 64, 35-62.
- Baumeister, R. F., & Vohs, K. D. (2004). *Handbook of self-regulation: Research, theory, and applications*. New York: Guilford.
- Beck, A.T., Steer, R.A., & Brown, G.K. (1996). *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation.
- Berg, K. C., Peterson, C. B., Frazier, P., & Crow, S. J. (2012). Psychometric evaluation of the Eating Disorder Examination and Eating Disorder Examination-Questionnaire: A systematic review of the literature. *International Journal of Eating Disorders*, 45(3), 428-438.
- Brewin, N., Baggott, J., Dugard, P., & Arcelus, J. (2014). Clinical normative data for eating disorder examination questionnaire and eating disorder inventory for DSM-5 feeding and eating disorder classifications: A retrospective study of patients formerly diagnosed via DSM-IV. *European Eating Disorders Review*, 22(4), 299-305.
- Brooks, M., Kay-Lambkin, F., Bowman, J., & Childs, S. (2012). Self-compassion amongst clients with problematic alcohol use. *Mindfulness*, 3(4), 308-317.
- Brown, J. D., & Dutton, K. A. (1995). The thrill of victory, the complexity of defeat: Self-esteem and people's emotional reactions to success and failure. *Journal of Personality and Social Psychology*, 68(4), 712-722. doi:10.1037//0022-3514.68.4.712
- Bruce, B., & Agras, W. (1992). Binge eating in females: A population-based investigation. *International Journal of Eating Disorders*, 12(4), 365-373.

- Cepeda-Benito, A., Fernandez, M. C., & Moreno, S. (2003). Relationship of gender and eating disorder symptoms to reported cravings for food: Construct validation of state and trait craving questionnaires in Spanish. *Appetite*, 40(1), 47-54.
- Cooper, M. J., Todd, G., & Well, A. (2000). *Bulimia nervosa: A cognitive therapy programme for clients*. London: Jessica Kingsley.
- Deaver, C. M., Miltenberger, R. G., Smyth, J., Meidinger, A., & Crosby, R. (2003). An evaluation of affect and binge eating. *Behavior Modification*, 27(4), 578-599.
- Depue, R. A., & Morrone-Strupinsky, J. V. (2005). A neurobehavioral model of affiliative bonding: Implications for conceptualizing a human trait of affiliation. *Behavioral and Brain Sciences*, 28(3), 313-350.
- Duarte, J., McEwan, K., Barnes, C., Gilbert, P., & Maratos, F. A. (2015). Do therapeutic imagery practices affect physiological and emotional indicators of threat in high self-critics? *Psychology and Psychotherapy: Theory Research and Practice*, 88(3), 270-284. doi:10.1111/papt.12043
- Dunlap, W.P., Cortina, J.M., Vaslo, J.B., & Burke, M.J. (1996). Meta-analysis of experiments with matched groups or repeated measures designs. *Psychological Methods*, 1(2), 170-177.
- Fairburn, C. G. (2008). *Cognitive Behavior Therapy and Eating Disorders*. New York: The Guilford Press.
- Fairburn, C. G., Cooper, Z., & O'Connor, M. E. (2008). Eating Disorder Examination (ed. 16.0D). In C. G. Fairburn (Ed.), *Cognitive behavior therapy and eating disorders* (pp. 265–308). New York: Guilford Press.

- Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: a "transdiagnostic" theory and treatment. *Behaviour Research and Therapy*, 41(5), 509-528. doi:10.1016/s0005-7967(02)00088-8
- Fairburn, C. G., Beglin, S. J. (2008). Eating Disorder Examination Questionnaire (6.0). In C. G. Fairburn (Eds.), *Cognitive Behavior Therapy and Eating Disorders*. New York: Guilford Press.
- Falconer, C. J., King, J. A., & Brewin, C. R. (2015). Demonstrating mood repair with a situation-based measure of self-compassion and self-criticism. *Psychology and Psychotherapy: Theory, Research and Practice*, 88(4), 351-365.
- Falconer, C. J., Slater, M., Rovira, A., King, J. A., Gilbert, P., Antley, A., & Brewin, C. R. (2014). Embodying compassion: A virtual reality paradigm for overcoming excessive self-criticism. *PLoS ONE*, 9(11), e111933.
- Farmer, R. F., Nash, H. M., & Field, C. E. (2001). Disordered eating behaviors and reward sensitivity. *Journal of Behavior Therapy and Experimental Psychiatry*, 32(4), 211-219.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175-191. doi:10.3758/bf03193146
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. London, UK: SAGE.
- Gale, C., Gilbert, P., Read, N., & Goss, K. (2014). An evaluation of the impact of introducing compassion focused therapy to a standard treatment programme for people with eating disorders. *Clinical Psychology and Psychotherapy*, 21(1), 1-12. doi:10.1002/cpp.1806

- Gilbert, P. (2010). *Compassion focused therapy: Distinctive features*. London, UK: Routledge.
- Gilbert, P. (2000). Social mentalities: internal 'social' conflicts and the role of inner warmth and compassion in cognitive therapy. In: P. Gilbert & K. G. Bailey (Eds.), *Genes on the Couch: Explorations in Evolutionary Psychotherapy* (pp. 118–150). Hove: Psychology Press.
- Gilbert, P. (2009). *The Compassionate Mind*. London, UK: Constable & Robinson Ltd.
- Gilbert, P., Clarke, M., Hempel, S., Miles, J. N. V., & Irons, C. (2004). Criticizing and reassuring oneself: An exploration of forms, styles and reasons in female students. *British Journal of Clinical Psychology*, 43, 31-50. doi:10.1348/014466504772812959
- Gilbert, P., & Irons, C. (2005). Focused therapies and compassionate mind training for shame and self-attacking. In: P. Gilbert (Ed.), *Compassion: Conceptualisations, Research and Use in psychotherapy* (pp.263-325). London: Routledge.
- Gilbert, P., McEwan, K., Matos, M., & Rivis, A. (2011). Fears of compassion: Development of three self-report measures. *Psychology and Psychotherapy: Theory, Research and Practice*, 84(3), 239-255.
- Gilbert, P., McEwan, K., Mitra, R., Franks, L., Richter, A., & Rockliff, H. (2008). Feeling safe and content: A specific affect regulation system? Relationship to depression, anxiety, stress, and self-criticism. *The Journal of Positive Psychology*, 3(3), 182-191.
- Gilbert, P., & Procter, S. (2006). Compassionate mind training for people with high shame and self-criticism: Overview and pilot study of a group therapy

- approach. *Clinical Psychology & Psychotherapy*, 13(6), 353-379.
doi:10.1002/cpp.507
- Goss, K. (2007). Shame, social rank, self-directed hostility, self-esteem, and eating disorders. Unpublished doctoral dissertation: Univeristy of Leicester.
- Goss, K., & Allan, S. (2010). Compassion Focused Therapy for Eating Disorders. *International Journal of Cognitive Therapy*, 3(2), 141-158.
- Goss, K. P., & Gilbert, P. (2002). Eating disorders, shame and pride: a cognitive-behavioural functional analysis. In P. Gilbert & J. Miles (Eds.), *Body shame: Conceptualisation, research and treatment* (pp. 219-255). Hove, UK: Brunner-Routledge.
- Grabhorn, R., Stenner, H., Stangier, U., & Kaufhold, J. (2006). Social Anxiety in Anorexia and Bulimia Nervosa: The Mediating Role of Shame. *Clinical Psychology & Psychotherapy*, 13(1), 12-19.
- Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, 110(1), 86-108. doi:10.1037//0033-2909.110.1.86
- Herman, C., & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality*, 43(4), 647-660.
- Herman, C. P., & Polivy, J. (2004). The self-regulation of eating: Theoretical and practical problems. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory and applications* (pp. 409-508). New York: Guildford.
- Holmes, E.A., & Matthews, A. (2010). Mental imagery in emotion and emotional disorders. *Clinical Psychology Review*, 30, 349-362.

- Hope, N., Koestner, R., & Milyavskaya, M. (2014). The role of self-compassion in goal pursuit and well-being among university freshmen. *Self and Identity*, 13(5), 579-593.
- Hudson, J. I., Hiripi, E., Pope, H. G., Jr., & Kessler, R. C. (2007). The Prevalence and Correlates of Eating Disorders in the National Comorbidity Survey Replication. *Biological Psychiatry*, 61(3), 348-358.
- Kamboj, S. K., Kilford, E. J., Minchin, S., Moss, A., Lawn, W., Das, R. K., & Freeman, T. P. (2015). Recreational 3,4-methylenedioxy-N-methylamphetamine (MDMA) or 'ecstasy' and self-focused compassion: Preliminary steps in the development of a therapeutic psychopharmacology of contemplative practices. *Journal of Psychopharmacology*, 29(9), 961-970. doi:10.1177/0269881115587143
- Karakaya, O., Barutcu, I., Kaya, D., Esen, A. M., Saglam, M., Melek, M., & Kaymaz, C. (2007). Acute effect of cigarette smoking on heart rate variability. *Angiology*, 58(5), 620-624. doi:10.1177/0003319706294555
- Karason, K., Molgaard, H., Wikstrand, J., Sjostrom, L. (1999). Heart rate variability and the effect of weight loss. *American Journal of Cardiology*, 83(3), 1242-1247
- Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology*, 3, 1-27.
- Kelly, A. C., & Carter, J. C. (2015). Self-compassion training for binge eating disorder: A pilot randomized controlled trial. *Psychology and Psychotherapy: Theory, Research and Practice*, 88(3), 285-303. doi:10.1111/papt.12044
- Kelly, A. C., Carter, J. C., Zuroff, D. C., & Borairi, S. (2013). Self-compassion and fear of self-compassion interact to predict response to eating disorders

- treatment: a preliminary investigation. *Psychotherapy Research*, 23(3), 252-264. doi:10.1080/10503307.2012.717310
- Kelly, A. C., Vimalakanthan, K., & Carter, J. C. (2014). Understanding the roles of self-esteem, self-compassion, and fear of self-compassion in eating disorder pathology: an examination of female students and eating disorder patients. *Eating Behaviors*, 15(3), 388-391. doi:10.1016/j.eatbeh.2014.04.008
- Kelly, A. C., Wisniewski, L., Martin-Wagar, C., & Hoffman, E. (2017). Group-based compassion-focused therapy as an adjunct to outpatient treatment for eating disorders: A randomized controlled trial. *Clinical Psychology and Psychotherapy*, 24(2), 475-487.
- Kelly, A. C., Zuroff, D. C., Foa, C. L., & Gilbert, P. (2010). Who Benefits from Training in Self-Compassionate Self-Regulation? A Study of Smoking Reduction. *Journal of Social and Clinical Psychology*, 29(7), 727-755.
- Kincaid, J. P., Fishburne, R. P., Jr., Rogers, R. L., & Chissom, B. S. (1975). Derivation of New Readability Formulas (Automated Readability Index, Fog Count and Flesch Reading Ease Formula) for Navy Enlisted Personnel (No. RBR-8-75). Millington, TN, Research Branch: Naval Technical Training Command.
- Laberg, J. C., Wilson, G., Eldredge, K., & Nordby, H. (1991). Effects of mood on heart rate reactivity in bulimia nervosa. *International Journal of Eating Disorders*, 10(2), 169-178.
- Lima, A., Forjaz, C. L. D., Silva, G. Q. D., Meneses, A. L., Silva, A., & Ritti-Dias, R. M. (2011). Acute Effect of Resistance Exercise Intensity in Cardiac Autonomic Modulation After Exercise. *Arquivos Brasileiros De Cardiologia*, 96(6), 498-503.

- Longe, O., Maratos, F. A., Gilbert, P., Evans, G., Volker, F., Rockliff, H., & Rippon, G. (2010). Having a word with yourself: Neural correlates of self-criticism and self-reassurance. *Neuroimage*, 49(2), 1849-1856. doi:10.1016/j.neuroimage.2009.09.019
- Magnus, C. M., Kowalski, K. C., & McHugh, T-L. F. (2010). The role of self-compassion in women's self-determined motives to exercise and exercise-related outcomes. *Self and Identity*, 9(4), 363-382.
- McFarlin, D. B., & Blascovich, J. (1984). On the remote associates test (RAT) as an alternative to illusory performance feedback: A methodological note. *Basic and Applied Social Psychology*, 5(3), 223-229. doi:10.1207/s15324834basp0503_5
- Napolitano, M. A., & Himes, S. (2011). Race, weight, and correlates of binge eating in female college students. *Eating Behaviors*, 12(1), 29-36.
- Neff, K. (2003). Self-Compassion: An Alternative Conceptualization of a Healthy Attitude Toward Oneself. *Self and Identity*, 2(2), 85-101. doi:10.1080/15298860390129863
- Neff, K. D., & Germer, C. K. (2013). A pilot study and randomized controlled trial of the mindful self-compassion program. *Journal of Clinical Psychology*, 69(1), 28-44.
- Nolen-Hoeksema, S., & Morrow, J. (1993). Effects of rumination and distraction on naturally occurring depressed mood. *Cognition & Emotion*, 7(6), 561-570. doi:10.1080/02699939308409206
- Notarius, C. F., Morris, B. L., & Floras, J. S. (2006). Caffeine attenuates early post-exercise hypotension in middle-aged subjects. *American Journal of Hypertension*, 19(2), 184-188. doi:10.1016/j.amjhyper.2005.07.022

- Oliveira, V. R., Ferreira, C., Mendes, A. L., & Marta-Simoes, J. (2017). Shame and eating psychopathology in Portuguese women: Exploring the roles of self-judgment and fears of receiving compassion. *Appetite, 110*, 80-85. doi:10.1016/j.appet.2016.12.012
- Pagani M., Lombardi F., Guzzetti S., Rimoldi O., Furlan R., Pizzinelli P., et al. (1986). Power spectral analysis of heart rate and arterial pressure variabilities as a marker of sympatho-vagal interactions in man and conscious dog. *Circulation Research, 59*, 178–193.
- Pagani M., Lombardi F., Guzzetti S., Sandrone G., Rimoldi O., Malfatto G., et al. (1984). Power spectral density of heart rate variability as an index of symphtho-vagal interactions in normal and hypertensive subjects. *Journal of Hypertension. Supplement. 2*, 383–385.
- Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology, 74*(2), 116-143. doi:10.1016/j.biopsycho.2006.06.009
- Robbins, T.W., & Fray, P.J. (1980). Stress-induced eating — Fact, fiction or misunderstanding? *Appetite, 1*, 103–133.
- Rockliff, H., Gilbert, P., McEwan, K., Lightman, S., & Glover, D. (2008). A pilot exploration of heart rate variability and salivary cortisol responses to compassion-focused imagery. *Clinical Neuropsychiatry: Journal of Treatment Evaluation, 5*(3), 132-139.
- Saules, K. K., Collings, A. S., Hoodin, F., Angelella, N. E., Alschuler, K., Ivezaj, V., & Wiedemann, A. A. (2009). The contributions of weight problem perception, BMI, gender, mood, and smoking status to binge eating among college students. *Eating Behaviors, 10*(1), 1-9.

- Schulz, S., Laessle, R. G. (2010). Associations of negative affect and eating behaviour in obese women with and without binge-eating disorder. *Eating Weight Disorders, 15*, e287-e293.
- Smyth, J. M., Wonderlich, S. A., Heron, K. E., Sliwinski, M. J., Crosby, R. D., Mitchell, J. E., & Engel, S. G. (2007). Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology, 75*(4), 629-638.
- Sobik, L., Hutchison, K., & Craighead, L. (2005). Cue-elicited craving for food: A fresh approach to the study of binge eating. *Appetite, 44*(3), 253-261.
- Stickney, M. I., Miltenberger, R. G., & Wolff, G. (1999). A descriptive analysis of factors contributing to binge eating. *Journal of Behavior Therapy and Experimental Psychiatry, 30*(3), 177-189. doi:10.1016/s0005-7916(99)0019-1
- Stunkard, A. J., & Allison, K. C. (2003). Two forms of disordered eating in obesity: Binge eating and night eating. *International Journal of Obesity, 27*(1), 1-12.
- Svaldi, J., Caffier, D., Tuschen-Caffier, B. (2010). Emotion suppression but not reappraisal increases desire to binge in women with binge eating disorder. *Psychotherapy and Psychosomatics, 79*, 188-190.
- Svaldi, J., Tuschen-Caffier, B., Trentowska, M., Caffier, D., & Naumann, E. (2014). Differential caloric intake in overweight females with and without binge eating: Effects of a laboratory-based emotion-regulation training. *Behaviour Research and Therapy, 56*, 39-46. doi:10.1016/j.brat.2014.02.008
- Swan, S., & Andrews, B. (2003). The relationship between shame, eating disorders and disclosure in treatment. *British Journal of Clinical Psychology, 42*, 367-378. doi:10.1348/014466503322528919

- Tarvainen, M.P., Niskanen, J-P., Lipponen, J.A., Ranta-Aho, P.O., Karjalainen, P.A. (2014). Kubios HRV- heart rate variability analysis software. *Computer Methods and Programs in Biomedicine*, 113(1), 210-220.
- Task Force of the European Society of Cardiology (1996). Heart rate variability standards of measurement, physiological interpretation, and clinical use. *European Heart Journal*, 17, 354-381.
- Thompson, E. R. (2007). Development and validation of an internationally reliable short-form of the positive and negative affect schedule (Panas). *Journal of Cross-Cultural Psychology*, 38(2), 227-242. doi:10.1177/0022022106297301
- Troop, N. A., Allan, S., Serpell, L., & Treasure, J. L. (2008). Shame in Women with a History of Eating Disorders. *European Eating Disorders Review*, 16(6), 480-488. doi:10.1002/erv.858
- Wagner, D. D., Boswell, R. G., Kelley, W. M., & Heatherton, T. F. (2012). Inducing negative affect increases the reward value of appetizing foods in dieters. *Journal of Cognitive Neuroscience*, 24(7), 1625-1633.
- Wang, Y-P., & Gorenstein, C. (2013). Psychometric properties of the Beck Depression Inventory-II: a comprehensive review. *Revista Brasileira de Psiquiatria*, 35(4), 416-431.
- Waters, A., Hill, A., & Waller, G. (2001). Bulimics' responses to food cravings: Is binge-eating a product of hunger or emotional state? *Behaviour Research and Therapy*, 39(8), 877-886.
- Wierenga, C. E., Ely, A., Bischoff-Grethe, A., Bailer, U. F., Simmons, A. N., & Kaye, W. H. (2014). Are extremes of consumption in eating disorders related to an altered balance between reward and inhibition? *Frontiers in Behavioral Neuroscience*, 8, 1-11.

Part three: Critical Appraisal

Introduction

This critical appraisal will reflect on clinical observations and theoretical perspectives that informed my choice of topic for the literature review and empirical paper. I will then comment on what I learnt about the design and reporting of treatment trials through the process of undertaking a systematic review, and discuss implications for future research. The experience of conducting my own research will then be reflected upon, with particular reference to recruitment, the sample and dilemmas that arose. The appraisal will conclude with a discussion of the findings within a broader context.

Choice of topic

"You inflict it upon yourself because your self-esteem is at a low ebb, and you don't think you're worthy or valuable. You fill your stomach up four or five times a day - some do it more - and it gives you a feeling of comfort...It's like having a pair of arms around you, but it's temporary. Then you're disgusted at the bloatedness of your stomach, and then you bring it all up again."

Diana, Princess of Wales

The theoretical model of binge eating that dominates the scientific literature and is most applied in clinical practice, is the model developed by Fairburn and colleagues. This proposes that the over-evaluation of weight and shape and its control leads to strict dietary restraint and dietary rules, and that binge eating occurs as a result of rigid and restrictive eating (Fairburn, Cooper, & Shafran, 2003). Considerable empirical evidence dating back to the 1940s supports this view

(Heatherton & Polivy, 1992; Key, Brozek, Henschel, Mickelson, & Taylor, 1950; Wilson & Fairburn, 1993). The importance of dietary restraint as a maintenance factor has been further established in a recent review, which found that early reductions in dietary restraint consistently mediated treatment outcomes (Linardon, Piedad Garcia, & Brennan, 2017). As a scientist practitioner this awareness of the evidence-base informed my clinical practice. During my placement within an eating disorder service, I felt confident that reducing dietary restraint and rigidity through balanced regular eating, a key intervention in CBT for eating disorders, could help those who wanted to stop binge eating. Consequently, in early therapy sessions with service users, priority was given to establishing regular eating. This also involved exploring and testing any barriers to implementing regular eating, such as fear of rapid weight gain. I think my belief in this intervention and the fact that I was able to share the research with clients increased expectations of recovery and credibility of the intervention. Both of these factors are non-specific therapeutic factors that are well known to be associated with therapeutic outcomes (Constantino, Glass, Arnkoff, Ametrano, & Smith, 2011).

Although binge eating often starts as a result of strict dieting (Kendler et al., 1991; Leon, Fulkerson, Perry, & Early-Zald, 1995), as the Diana quote portrays, it soon develops to encompass much more than this. For many, it can become the main way of coping with negative self-perceptions and emotional distress (Heatherton & Baumeister, 1991). This was also reflected in my experience of working in an eating disorder service. Despite clients reinstating regular eating, many still binged to cope with emotional distress. In addition, binge eating disorder (BED) is the most common eating disorder (Beat, 2015), and by definition is not characterised by extreme dietary restraint or other extreme weight loss behaviours (American

Psychiatric Association, 2013). However, the restraint model is still the dominant model applied in practice for this client group. This suggests that new conceptualisations and treatments for binge eating disorders are desperately needed. This triggered my interest in studying the emotional function of binge eating. As a scientific practitioner I wanted to specifically explore the causal role of emotion regulation in binge eating to help increase confidence that this was an important factor to consider in formulations and prioritise in treatment.

The above motivated me to undertake a systematic review of the literature of Dialectical Behavioural Therapy (DBT) for eating disorders, with a focus on synthesising findings on potential mechanisms of action. I also held in mind that emotional aspects of eating might not be as important for some people affected by eating disorders. I therefore also wanted to explore moderators of therapeutic outcome to help inform what treatment works best for whom.

The idea to examine self-compassion for my empirical paper was also informed by my clinical experiences. I was surprised and saddened by the frequent expressions of self-hatred and self-dislike of the people with eating disorders I had contact with. Many also described feeling ambivalent about not bingeing, as they feared losing the one thing that gave them comfort. I was also struck by Princess Diana's description that bingeing felt like having arms wrapped around you. My interpretation of this quote, which is often echoed in the accounts of why people binge, is that binge eating has a calming and soothing physiological effect. The developers of compassion-focused therapies propose that these physiological effects can be simulated through self-compassion (Gilbert, 2010). Consequently, I was interested in this approach as a way of managing distress from a felt sense as well.

Literature Review

A vital step in increasing confidence that an intervention works is that of replication and comparing findings. An increasing evidence base of DBT for BED and Bulimia Nervosa (BN) is developing and overall the results appear promising. However, I found it difficult to directly compare, synthesis and draw conclusions from the findings because of the different modifications of DBT tested and diversity of outcome measures reported. Some studies reported changes in binge-purge frequency as their primary outcome, while others reported body mass index (BMI), binge-purge abstinence or changes in EDE-Q scores. The diversity of primary outcomes also meant that findings could not be pooled together using meta-analytical techniques to establish overall effectiveness (Boland, Cherry, & Dickinson, 2014). Diversity in outcome measures is reflective of the general literature on intervention studies for eating disorders, which makes it difficult to compare findings relative to other treatments. This is necessary to help establish the relative effectiveness of interventions, especially in the absence of randomised control trials comparing treatments, which the current evidence base is limited by. The difficulty of diverse measures for summarising scientific knowledge has been frequently highlighted. Consequently, researchers are advocating for a universally agreed definition of recovery in eating disorders (Williams, Watts, & Wade, 2012). At present the definition that appears most useful as it can be used transdiagnostically and clearly differentiates eating disordered samples from healthy controls, is the definition proposed by Bardone-Cone et al. (2010): (i) $BMI \geq 18.5$; (ii) abstinence from bingeing, purging, and fasting for three months; and (iii) achieving an EDE-Q global score within healthy population norms.

My clinical practice is influenced by recovery models that emphasise that recovery is personally defined and encompasses much more than symptom reduction (Ramon, Healy, & Renouf, 2007). However, I can now appreciate how a universal definition of recovery would facilitate the advancement of our understanding of how and why and for whom interventions work.

The majority of studies reviewed in the systematic review evaluated DBT as a treatment for BN and BED, and few studies investigated it as a treatment for Anorexia Nervosa (AN). DBT applied to BN and BED is grounded in a strong theoretical model that bingeing becomes a dysfunctional way of attempting to cope with difficult emotions. Therefore the model predicts that improved emotion regulation results in a reduction of eating disordered behaviours. Emotion regulation deficits are also reported among women with AN (Lavender et al., 2015). In addition, the physiological state of being underweight appears to dampen emotions, which is proposed to reinforce the disorder (Robinson & McHugh, 1995). However, the function of starvation does not result in the same, immediate and contingent reduction in negative affect as bingeing does. Therefore DBT, with its focus on learning to cope with emotion distress in the moment, does not seem such a good conceptual fit for AN. This may account for the disparity of studies of DBT for different eating disorder diagnoses.

A strength of DBT for BN and BED, is that it is based on a strong theoretical model, and I was pleased to see that many studies attempted to examine the role of emotion regulation. However, as mentioned in the literature review, the majority of studies investigated this by including a measure of emotion regulation pre- and post-treatment. This method of analysis does not allow for causal specificity of potential mechanisms of action to be assessed. Kraemer and colleagues have published

guidelines on how to conduct and analyse trials that examine treatment mechanisms (Kraemer, Wilson, Fairburn, & Agras, 2002), but these were not applied in the studies reviewed. Determining mechanisms of actions requires large sample sizes to have adequate power to detect mediation effects (Fritz & MacKinnon, 2007). It also requires repeated measurements of hypothesised variables of action and outcomes to determine temporal precedence of changes in mechanism variables, among other criteria (Kraemer et al., 2002). Conducting large-scale studies of this nature is costly and laborious and often not feasible. Combining data from multiple independent studies is therefore needed to identify predictors, moderators and mediators of treatment outcomes, as this counteracts the problem of small sample sizes and underpowered studies. However, again this relies on the reporting of similar outcomes and measurement of variables of interest so that data can be aggregated. It also requires statistical data even for non-significant findings to be reported, which was often not the case in the studies reviewed.

I also noticed that the measurements of “emotion regulation” used changed over time. As research develops so too does our understanding and conceptualisation of processes such as emotion regulation. This also makes it difficult to summarise findings as measures change and become potentially invalid with increased scientific knowledge.

Overall, the process of undertaking the systematic review highlighted design features and aspects related to the reporting of data that could increase the explanatory power of treatment trials and facilitate the advancement of treatments. These include using consistent definitions of outcomes, reporting null findings and more frequent measurements of proposed mechanisms of change and outcomes. It also highlighted that establishing mechanisms of actions using RCTs is complex and

resource heavy. It should therefore be preceded by less costly and time-consuming laboratory studies that can narrow down and test the alleged mechanisms of action first.

Empirical paper

The role of self-compassion in the development and maintenance of eating disorders has gained increased interest in the past few years. At present there is strong evidence of an association between low levels of trait self-compassion, fear of self-compassion and eating disorder symptoms, based on mostly cross-sectional and longitudinal study designs (Braun, Park, & Gorin, 2016).

Cross-sectional and longitudinal studies are well suited for identifying possible clinical processes that are involved in the development of disorders. However, evidence of an association does not demonstrate causality. Directly manipulating variables that are assumed to be related to symptoms in well-controlled laboratory experiments is a valuable and cost-effective way of learning about the causal status of variables (Zvolensky, Lejuez, Stuart, & Curtin, 2001). Indeed, many of the claims of the benefits of self-compassion are derived from experimental studies (Breines & Chen, 2012; Leary, Tate, Adams, Allen, & Hancock, 2007).

As only one experimental study has researched the causal effects of self-compassion on eating behaviour, I believed that further experimental studies would add to the evidence-base regarding the importance or non-importance of this factor in treatment. This and the time and resource restraints inherent in undertaking research as part of the DClinPsy course motivated me to undertake an experimental study for my research.

I also wanted to study a non-treatment seeking population because less than 30% of individuals with eating disorders will seek help, despite struggling with eating difficulties that cause a significant amount of distress and impairment (Micali et al., 2017; Solmi, Hotopf, Hatch, Treasure, & Micali, 2016). Thus, I wanted to study a population that is potentially more representative of the majority of people struggling with binge eating difficulties, than a treatment-accessing sample may be.

I had anticipated that there would be many people who struggled with binge eating difficulties among London student populations based on student prevalence studies (Napolitano & Himes, 2011; Saules, Carey, Carr, & Sienko, 2015) and my own observations as a student. However, I was still surprised at the level of interest in the study and ease and rapidity of recruitment. I was also surprised by the ethnic diversity of the sample, and in particular the high percentage of women of Chinese origin. This is likely to be because of the high percentage of international students attending the university where the study took place. In addition, recent prevalence studies suggest that Asian and Afro-Caribbean population's risk of developing eating disorders is similar to or even higher than White-British populations (Solmi et al., 2016). However, studies of utilization of services show that people of ethnic minorities are significantly underrepresented in eating disorder services (Waller et al., 2009).

Research has begun to explore barriers to accessing eating disorder services. At present, lack of awareness and understanding of eating disorders and concerns about stigma appear to be the main barriers to accessing services (Chowbey, Salway, & Ismail, 2012). The recruitment of a high percentage of women of ethnic minorities in this study may suggest that participating in research could be a less stigmatising way of finding out about eating disorders, for those who struggle with eating

difficulties. Overall, perhaps studying non-treatment accessing student populations of universities with a high percentage of international students could be a way of studying more ethnically diverse groups.

In addition to advantages of recruiting this sample, there were also significant challenges associated with recruiting people who are not currently accessing services, particularly in terms of risk management. During the experimental session, participants were asked to complete the Beck Depression Inventory (Beck, Steer, & Brown, 1996), which contains a question about current suicidal thoughts. Prior to recruitment my supervisors and I had developed a risk protocol of what to do in the event that a participant disclosed that they felt suicidal. Despite having a clear risk protocol, the disclosure of suicidal thoughts felt very anxiety provoking. This was partly because I am used to working in clinical settings where risk information is shared and managed among a network of professionals to ensure the person gets the support they need. However, in this setting I felt isolated and somewhat helpless in terms of the support that could be provided. I did not have participant's GP information so I could not inform their GP about their disclosure of risk. Also, even though I asked participants who felt suicidal whether I could contact their GP to help them access support no one wanted this. The fact that all I could do was signpost people to services and hope they would seek help if they felt at crisis point felt uncontainable. In addition, eating disordered behaviours such as laxative misuse and purging pose significant health risks, and again it felt insufficient to make people aware of these risks and encourage them to access help. This would make me cautious about recruiting a non-treatment accessing group that engage in high-risk behaviours or are at increased risk of suicide in the future.

As a scientific practitioner I am attracted to experimental study designs as stated above because they enable the causality of alleged change mechanisms to be tested in a quick and cost-effective way. However, the experience of undertaking an experiment came with its own challenges. In particular, designing the response strategies proved difficult. Although I used strategies from reliable, well-known sources, I adapted the strategies to ensure they were closely matched. For example, so that they were matched in terms of readability, duration and attentional demands. Although the matching of strategies increases confidence that the effects were due to specific components of the strategy rather than non-specific elements such as time and attention demands, the adaption of previously established strategies reduces the validity of the findings. However, the fact that I used physiological measures as well as self-report measures before and after each strategy/induction does provide some support for the validity of the strategies and induction. In addition, although the effectiveness of the induction and strategies was good for scientific knowledge, on a personal level it felt uncomfortable inducing negative mood and self-critical rumination, albeit in a mild and transient form. In future I will consider more how the experiment is experienced by both participants and the researcher conducting it, when designing research.

Conclusion

To conclude, the research aimed to explore the emotional function of disordered eating behaviours, firstly, by reviewing the research on DBT for eating disorders and then through an experimental study exploring the role of self-compassion and self-critical rumination in binge eating behaviour. The findings suggest that learning to regulate emotions, for example through the cultivation of self-compassion, could potentially reduce eating disordered behaviours such as binge

eating. The implications of this confirm the importance of focusing on emotion regulation and self-compassion, which newer treatments for eating disorders are beginning to incorporate. In contrast, weight management interventions still tend to neglect the emotional causes of overeating. Obesity levels are escalating (Ng et al., 2014) and account for a significant proportion of health costs in the UK (Branca, Nikogosian, & Lobstein, 2007). Although not focused specifically on obese participants, the studies tentatively suggest that facilitating emotion regulation through the cultivation of self-compassion could improve the self-regulation of eating behaviours and hence the effectiveness of weight loss programmes. Future research should explore this possibility.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Bardone-Cone, A. M., Harney, M. B., Maldonado, C. R., Lawson, M. A., Robinson, D. P., Smith, R., et al. (2010). Defining recovery from an eating disorder: Conceptualization, validation, and examination of psychosocial functioning and psychiatric comorbidity. *Behaviour Research and Therapy*, 48, 194–202. 10.1016/j.brat.2009.11.001.
- Beat. (2015). The cost of eating disorders. Social, health and economic impacts.
- Beck, A.T., Steer, R.A., & Brown, G.K. (1996). *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation.
- Boland, A. M., Cherry, G., & Dickson, R. (Eds.). (2014). *Doing a Systematic Review: A Student's Guide*. London: SAGE.

- Branca, F., Nikogosian, H., & Lobstein, T. (2007). *The challenge of obesity in the WHO European Region and the strategies for response: Summary*. World Health Organisation.
- Braun, T. D., Park, C. L., & Gorin, A. (2016). Self-compassion, body image, and disordered eating: A review of the literature. *Body Image, 17*, 117-131. doi:10.1016/j.bodyim.2016.03.003
- Breines, J. G., & Chen, S. (2012). Self-compassion increases self-improvement motivation. *Personality and Social Psychology Bulletin, 38*(9), 1133-1143.
- Chowbey, P., Salway, S., & Ismail, M. (2012). Influences on diagnosis and treatment of eating disorders among minority ethnic people in the UK. *Journal of Public Mental Health, 11*(2), 54-64.
- Constantino, M. J., Glass, C. R., Arnkoff, D. B., Ametrano, R. M., & Smith, J. Z. (2011). Expectations. In J. C. Norcross (Ed.), *Psychotherapy relationships that work: Therapist contributions and responsiveness to patients* (2nd ed.; 354-376). New York: Oxford University Press, Inc.
- Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: a "transdiagnostic" theory and treatment. *Behaviour Research and Therapy, 41*(5), 509-528. doi:10.1016/s0005-7967(02)00088-8
- Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18*(3), 233-239.
- Gilbert, P. (2010). *The Compassionate Mind*. London: Constable.
- Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin, 110*(1), 86-108. doi:10.1037//0033-2909.110.1.86

- Heatherton, T F., & Polivy, J. (1992). Chronic dieting and eating disorders: A spiral model. In J. H. Crowther, D. L. , Tennenbaum, S. E. Hobfold, & M A. Parris (Eds.), *The etiology of bulimia nervosa: The individual and familial context*. Washington, DC: Hemisphere.
- Kendler, K. S., MacLean, C., Neale, M., Kessler, R. C., Heath, A., & Eaves, L. (1991). The genetic epidemiology of bulimia nervosa. *The American Journal of Psychiatry*, 148(12), 1627-1637.
- Keys, A., Brozek, J., Henschel, A., Mickelson, O., & Taylor, H. L. (1950). *The biology of human starvation*. Minneapolis: University of Minnesota Press.
- Kraemer, H. C., Wilson, G. T., Fairburn, C. G., & Agras, W. S. (2002). Mediators and moderators of treatment effects in randomized clinical control trials. *Archives of General Psychiatry*, 59, 877-883.
- Lavender, J. M., Wonderlich, S. A., Engel, S. G., Gordon, K. H., Kaye, W. H., & Mitchell, J. E. (2015). Dimensions of emotion dysregulation in anorexia nervosa and bulimia nervosa: A conceptual review of the empirical literature. *Clinical Psychology Review*, 40, 111-122. doi:10.1016/j.cpr.2015.05.010
- Leary, M. R., Tate, E. B., Adams, C. E., Allen, A. B., & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: The implications of treating oneself kindly. *Journal of Personality and Social Psychology*, 92(5), 887-904.
- Leon, G. R., Fulkerson, J. A., Perry, C. L., & Early-Zald, M. B. (1995). Prospective analysis of personality and behavioral vulnerabilities and gender influences in the later development of disordered eating. *Journal of Abnormal Psychology*, 104(1), 140-149.

- Linardon, J., Piedad Garcia, X., & Brennan, L. (2017). Predictors, moderators, and mediators of treatment outcome following manualised cognitive-behavioural therapy for eating disorders: A systematic review. *European Eating Disorders Review*, 25, 3-12.
- Micali, N., Martini, M.G., Thomas, J.J., Eddy, K.T., Kothari, R., Russell, E., et al. (2017). Lifetime and 12-month prevalence of eating disorders amongst women in mid-life: a population-based study of diagnoses and risk factors. *BMC Medicine*, 15(12), 1-10.
- Napolitano, M. A., & Himes, S. (2011). Race, weight, and correlates of binge eating in female college students. *Eating Behaviors*, 12(1), 29-36.
- Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., Oti, S. O. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 384(9945), 766-781.
- Ramon, S., Healy, B., & Renouf, N. (2007). Recovery from Mental Illness as an Emergent Concept and Practice in Australia and the UK. *International Journal of Social Psychiatry*, 53(2), 108-122.
- Robinson, P. H., & McHugh, P. R. (1995). A physiology of starvation that sustains eating disorders. In G. Szmukler, C. Dare, & J. Treasure (Eds.), *Handbook of eating disorders* (1st ed.). Chichester: Wiley.
- Saules, K. K., Carey, J., Carr, M. M., & Sienko, R. M. (2015). Binge-eating disorder: Prevalence, predictors, and management in the primary care setting. *Journal of Clinical Outcomes Management*, 22(11), 512-528.

- Solmi, F., Hotopf, M., Hatch, S., Treasure, J., & Micali, N. (2016). Eating disorders in a multi-ethnic inner-city UK sample: Prevalence, comorbidity and service use. *Social Psychiatry and Psychiatric Epidemiology*, 51(3), 369-381.
- Waller, G., Schmidt, U., Treasure, J., Emanuelli, F., Alenya, J., Crockett, J., & Murray, K. (2009). Ethnic origins of patients attending specialist eating disorders services in a multiethnic urban catchment area in the United Kingdom. *International Journal of Eating Disorders*, 42(5), 459-463.
- Williams, S. E., Watts, T. K. O., & Wade, T. D. (2012). A review of the definitions of outcome used in the treatment of bulimia nervosa. *Clinical Psychology Review*, 32(4), 292-300.
- Wilson, G., & Fairburn, C. G. (1993). Cognitive treatments for eating disorders. *Journal of Consulting and Clinical Psychology*, 61(2), 261-269.
- Zvolensky, M. J., Lejuez, C., Stuart, G. L., & Curtin, J. J. (2001). Experimental psychopathology in psychological science. *Review of General Psychology*, 5(4), 371-381.

Appendices

Appendix A: Advertising Materials

Appendix B: Information Sheet

Appendix C: Consent Form

Appendix D: Ethical Approval

Appendix E: Means and standard deviations of mood states and state self-compassion and self-criticism at each time point

Appendix A

Advertising Materials

Poster and advertising email



Do you binge eat?

Binge eating research study

We are seeking women aged between 18 and 50 who binge eat at least once a week (or more) to take part in our research.

A binge is defined as eating a large amount of food in a short period of time, whilst experiencing a sense of lack of control over eating.

Research aims

The study is investigating psychological and physiological factors associated with binge eating to help improve our understanding of why people binge eat and current treatments for binge eating.

What will taking part involve?

Taking part will involve participating in a one-hour experiment at the Psychology department of University College London. During the session we will ask you to complete a series of tasks designed to measure thinking styles, perceptions about food and heart rate activity. You will be paid £10.00 for your time. Your participation in the study and data will be kept confidential and will be collected and stored in accordance with the Data Protection Act 1998. We will be recruiting throughout the summer 2016.

If you are interested in taking part please call or text Becky Amey (Trainee Clinical Psychologist) on 07414137063 or email her ucjtmey@ucl.ac.uk. Thank you for the taking the time to read this advert.

Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk	Binge eating study Tel: 07414137063 Email: ucjtmey@ucl.ac.uk
---	---	---	---	---	---	---	---	---	---

Do you binge eat?

UCL Binge Eating Research Study

We are seeking women aged between 18 ad 50 who binge eat to take part in our research study.

What is the purpose of the study?

The study aims to explore the associations between thinking styles, mood, physiological arousal and food preferences, in people who binge eat. We hope that this will help advance our understanding of why people binge eat and help improve current treatments for binge eating disorder and bulimia.

What will taking part involve?

If you decide to take part, a member of the research team will be in touch to conduct a short phone screening. Taking part will then involve participating in a one-hour experiment at the Psychology department of University College London. During the session we will ask you to complete a series of tasks designed to measure thinking styles, perceptions about food and heart rate activity. You will be paid £10.00 for your time. Your participation in the study and data will be kept confidential.

Who can take part?

We are looking for participants who are:

- Female
- Aged between 18 and 50
- Fluent in English
- Are not currently pregnant or breastfeeding
- Who binge, on average, at least once a week (or more)
- We are looking to recruit both people who engage in compensatory behaviours (vomiting, excessive exercise) and people who do not engage in compensatory behaviours.

What is a binge?

An episode of binge eating is characterised by both of the following:

- Eating, in a discrete period of time (e.g. within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances.
- A sense of lack of control over eating during the episode (e.g. a feeling that one cannot stop eating or control what or how much one is eating).

How can I take part?

If you are interested in taking part, or would like further information about the study, please contact the research team by email at ucjtmey@ucl.ac.uk or contact the lead researcher Becky Amey by phone: 07414137063.

Thank you for taking the time to read this advert.

Appendix B

Information Sheet

Information Sheet for

in Research Studies



You will be given a copy of this information sheet.

Title of Project: Binge Eating Research Study

Details of Study:

What is the study about?

The study aims to explore the associations between verbal reasoning, thinking styles, mood, heart rate activity and food preferences, in people who binge eat.

What will the study involve?

The study will involve having electrocardiographic (ECG) sensors placed below the collarbone and on the left hand side of the ribcage so we can measure your heart rate variability throughout the experiment. ECG is a completely safe and common method for measuring heart rate. You will then be asked to complete a series of tasks including a verbal reasoning task and a task designed to make you think about yourself. Finally we will ask you to rate the desirability and pleasantness of different food items. Participation will require you to answer a question about your current weight and height. If you do not know either of these the researcher will ask permission to measure them. The whole study should last approximately 1 hour.

Do I have to take part?

No your participation is completely voluntary. Choosing not to take part will not disadvantage you in any way. If you do decide to take part you are still free to withdraw at any time and without giving a reason.

What are the possible disadvantages or risks of taking part?

It is possible that you might experience some negative feelings for a short time after completing some tasks. If you would like immediate support please contact the researcher. If you would like general information and support about eating difficulties, please visit BEAT, <https://b-eat.co.uk>

Possible benefits of taking part

We hope that with your help this research will increase our understanding of binge eating and help improve current treatments for people who binge eat. If you would like a summary of the study's findings please tick the below box.

☐ Tick if you would like a summary of the project's findings

What happens with the information I provide?

Your participation in the study and data will be kept confidential and will be collected and stored in accordance with the Data Protection Act 1998. Your data may be used for the purpose of publication but in a way that maintains anonymity and confidentiality, hence no identifying information will be published. This study has been approved by the UCL Research Ethics Committee (Project ID Number: 7965/001)

Please do not hesitate to ask the researcher questions if anything is unclear or if you would like more information. You will also have the opportunity to discuss your experience of the experiment and any questions you may have at the end of the experiment.

Contact details of the researcher: Becky Amey (Trainee Clinical Psychologist), 1-19 Torrington Place, London, WC1E 7HB. Email: ucjtmey@ucl.ac.uk

Appendix C

Consent Form



Informed Consent Form for _____ in Research Studies

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Project: Binge Eating Research Study

This study has been approved by the UCL Research Ethics Committee (Project ID Number: 7965/001)

Thank you for your interest in taking part in this research. Before you agree to take part, the person organising the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to take part. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant's Statement

I

- have read the notes written above and the Information Sheet, and understand what the study involves.
- understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
- consent to the processing of my personal information for the purposes of this research study.
- understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.

- agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.

Signed:

Date:

Name:

Appendix D

Ethical Approval

**UCL RESEARCH ETHICS COMMITTEE
ACADEMIC SERVICES**



22 February 2016

Dr Lucy Serpell
Division of Psychology and Language Sciences
UCL

Dear Dr Serpell

Notification of Ethical Approval

Project ID: 7965/001: Effects of laboratory-based emotion regulation training on binge eating behaviour

Further to your satisfactory responses to the committee's comments, I am pleased to confirm in my capacity as Chair of the UCL Research Ethics Committee (REC) that your study has been approved by the UCL REC for the duration of the project until February 2017. Approval includes the approval of your amendment to the recruitment method to include advertising in gyms, on supermarket notice boards and locations that run weight loss groups.

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form': <http://ethics.grad.ucl.ac.uk/responsibilities.php>
2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator (ethics@ucl.ac.uk) immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

For non-serious adverse events the Chair or Vice-Chair of the Ethics Committee should again be notified via the Ethics Committee Administrator (ethics@ucl.ac.uk) within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

On completion of the research you must submit a brief report of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

Yours sincerely

Professor John Foreman
Chair of the UCL Research Ethics Committee

Academic Services, 1-19 Torrington Place (9th Floor),
University College London
Tel: +44 (0)20 3108 8216
Email: ethics@ucl.ac.uk
<http://ethics.grad.ucl.ac.uk/>

Appendix E

Means and standard deviations of mood states and state self-compassion and self-criticism at each time point

	T1 (Baseline)	T2 (after negative mood induction)	T3 (after response strategy)
TPAS (active)			
Compassion	19.37 (6.72)	14.80 (6.94)	15.40 (7.3)
Rumination	16.33 (4.96)	11.3 (6.61)	11.17 (6.75)
TPAS (relaxed)			
Compassion	13.4 (4.86)	9.90 (6.39)	17.47 (4.78)
Rumination	15.63 (4.42)	10.63(4.55)	14.23 (6.03)
TPAS (safe)			
Compassion	11.57 (2.81)	9.23 (3.66)	12.23 (2.91)
Rumination	11.97 (2.8)	9.07 (3.27)	10.4 (3.28)
PANAS (positive)			
Compassion	12.47 (3.48)	10.37 (3.35)	10.73 (4.448)
Rumination	10.23 (3.16)	8.63 (4.32)	8.4 (4.336)
PANAS (negative)			
Compassion	5.03 (3.40)	7.63 (4.58)	4.03 (3.25)
Rumination	3.83 (3.43)	6.37 (4.30)	5.33 (4.41)
State Self-Compassion			
Compassion	33.93 (16.43)	30.63 (16.14)	43.30 (20.23)
Rumination	35.37 (16.01)	30.63 (17.51)	35.53 (17.44)
State Self-Criticism			
Compassion	67.33 (17.85)	67.17 (22.18)	47.63 (21.91)
Rumination	64.67 (18.70)	66.3 (23.03)	59.8 (21.04)

Note. PANAS=Positive and Negative Affect Schedule; TPAS=Types of Positive Affect Scale